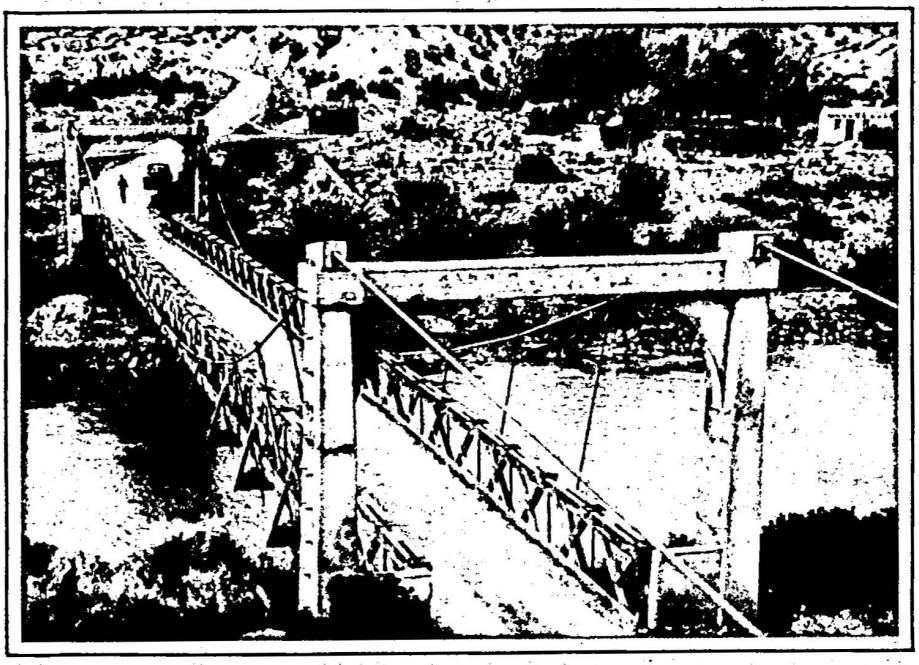
NEW MEXICO

HISTORIC BRIDGE SURVEY



New Mexico State Highway and Transportation Department

Federal Highway Administration • Region 6

Santa Fe • 1987

NEW MEXICO

HISTORIC BRIDGE SURVEY

Prepared by

Steven R. Rae
Joseph E. King
Donald R. Abbe

In coordination with the

New Mexico State Highway and Transportation Department
and the
Federal Highway Administration - Region 6

Santa Fe, New Mexico
1987

Cover Photo: Otowi Suspension Bridge Across the Rio Grande. Built in 1924.
(From Highway Department Bridge Files, Inactive)

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

FOREWORD

A large number of bridges in New Mexico are deteriorated and in need of repairs or replacement in order to meet load carrying and safety requirements. Other bridges in the state are functionally obsolete due to alignment, roadway width, present traffic load and other factors. Many bridges which are eligible for replacement under federal programs may meet the criteria for listing on the National Register of Historic Places. In order for federal funds to be used for repair or replacement of a bridge, eligibility for the National Register of Historic Places must be determined in accordance with the National Historic Preservation Act of 1966.

The purpose of the New Mexico Historic Bridge Survey is to identify bridges of particular engineering and historical significance and to gather information to serve as a basis for determining eligibility for the National Register of Historic Places. The Historic Bridge Survey was initiated by the New Mexico State Highway and Transportation Department in cooperation with the Federal Highway Administration and the State Historic Preservation Officer to improve judgment concerning National Register eligibility and to streamline the historical review process. The Historic Bridge Survey was also initiated to assist the Department in meeting other federal and state requirements which are applicable to historic bridges impacted by a proposed undertaking.

In addition to meeting regulatory requirements, the Historic Bridge Survey was prepared to provide an insight into bridge development in New Mexico. There is a growing interest in bridge development originating in part from the revival and preservation of covered timber bridges in New England and in other areas. There is now considerable awareness by historians, engineers and others that early bridge structures of all types which exhibit particular engineering achievement and historical significance should be considered as legitimate objects for recording and possible preservation.

On July 1, 1987, the name of the New Mexico State Highway Department was changed to the New Mexico State Highway and Transportation Department. Throughout this report, the old name of the Highway Department is used to refer to the Department in a historical context. The new name is used to refer to the Department as the successor organization for highways in New Mexico.

ACKNOWLEDGEMENTS

Funding for the New Mexico Historic Bridge Survey was provided by the New Mexico State Highway and Transportation Department, Dewey Lonsberry, Chief Highway Administrator, and by the Federal Highway Administration, Anthony L. Alonzo, Division Administrator.

The Historic Bridge Survey was prepared in consultation with the Historic Preservation Division of the Office of Cultural Affairs. We wish to thank the Division staff for their guidance and recommendations during the project.

The Historic Bridge Survey was initiated under the direction of Donald E. Clifton, formerly of the New Mexico State Highway and Transportation Department, and was completed under the supervision of Steven Koczan, State Highway Archeologist, and W. L. Taylor, Environmental Program Manager for the Department. The assistance of these individuals during the course of this project is hereby acknowledged and greatly appreciated.

Special thanks are expressed to George Grossman, James Parra and Martin Gavurnik of the New Mexico State Highway and Transportation Department Bridge Design Section for making their files available for our research and for their assistance on the project. Special thanks are also expressed to Phyllis Cohen for her help in collecting information on early bridges.

Information for the Historic Bridge Survey was obtained from many sources. We wish to thank the staff members of the following agencies and organizations for their assistance in our research.

Office of Cultural Affairs, Historic Preservation Division
Thomas W. Merlan, Director

State Records Center and Archives
Michael Miller, Director

Museum of New Mexico, History Bureau
Tom Chavez, Director

New Mexico State Library, Southwest Collection
Betty Sena, Director

Steven R. Rae, consulting engineer of Santa Fe, served as principal investigator for the Historic Bridge Survey under contract with the New Mexico State Highway and Transportation Department. Joseph E. King, Ph.D., and Donald R. Abbe, Ph.D., both of the Center for History of Engineering and Technology at Texas Tech University, served as historical consultants for the project. The Historical Overview of Road and Bridge Construction in New Mexico to 1956 included in this report was written by Dr. King with research assistance from Dr. Abbe.

Photographs of existing bridges contained in this report and not credited to other sources were taken by Steven Rae and printed by Nancy Warren of the Museum of New Mexico. The illustrations and design of this report were completed by graphic designer Louann Jordan of Santa Fe.

INTRODUCTION

The Historic Bridge Survey is to be used as a planning and management tool for the evaluation of early bridges in New Mexico. The survey is designed to:

- Permit the evaluation of individual bridges in the context of overall bridge development in the state;
- Identify the surviving number of bridges of each type and allow comparisons to be made of similar structures;
- Provide information concerning historical significance of individual bridges early in the planning process to allow for mitigation of the effect of a proposed undertaking; and,
- Eliminate bridges which do not have true merit from further consideration concerning eligibility for the National Register of Historic Places.

The Historic Bridge Survey includes bridges owned by the New Mexico State Highway and Transportation Department and by counties, municipalities and private organizations. The scope of this report is limited to the recording of vehicular bridges and several railroad bridges which were later used for vehicular traffic. Each bridge recorded in the survey is identified by its bridge inspection number assigned by the Department. If a bridge had no inspection number, it was assigned a number prefixed with an S during the survey.

This report is divided into four main parts: an overview of road and bridge construction in New Mexico; descriptions of recorded bridges; a summary of the evaluation work completed; and, a management plan for historic bridges. The overview and the descriptions of recorded bridges were prepared for those with a general interest in bridge development in New Mexico and to provide the background information required for evaluation of individual bridges. The remaining sections of this report were prepared to provide the State Historic Preservation Officer and others with information regarding bridge evaluation and selection. The list of selected bridges was included to identify bridges which exhibit exceptional historical and engineering qualities and which are potentially eligible for the National Register of Historic Places. This list may be used as the basis for a thematic group nomination to the National Register.

Bridges mentioned in the overview of road and bridge construction which still exist today are followed by their bridge numbers in parentheses. More information concerning an existing bridge may be found in the descriptions of recorded bridges. Bridges mentioned in the overview without bridge numbers have been demolished or removed to a new site.

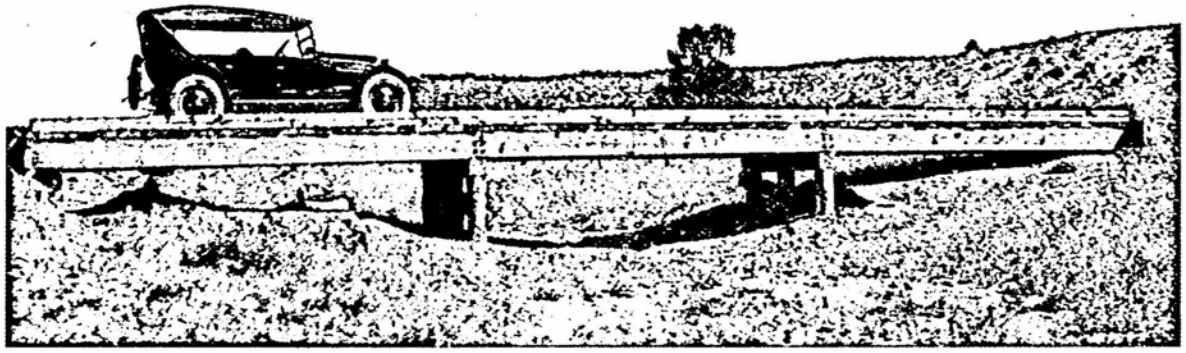
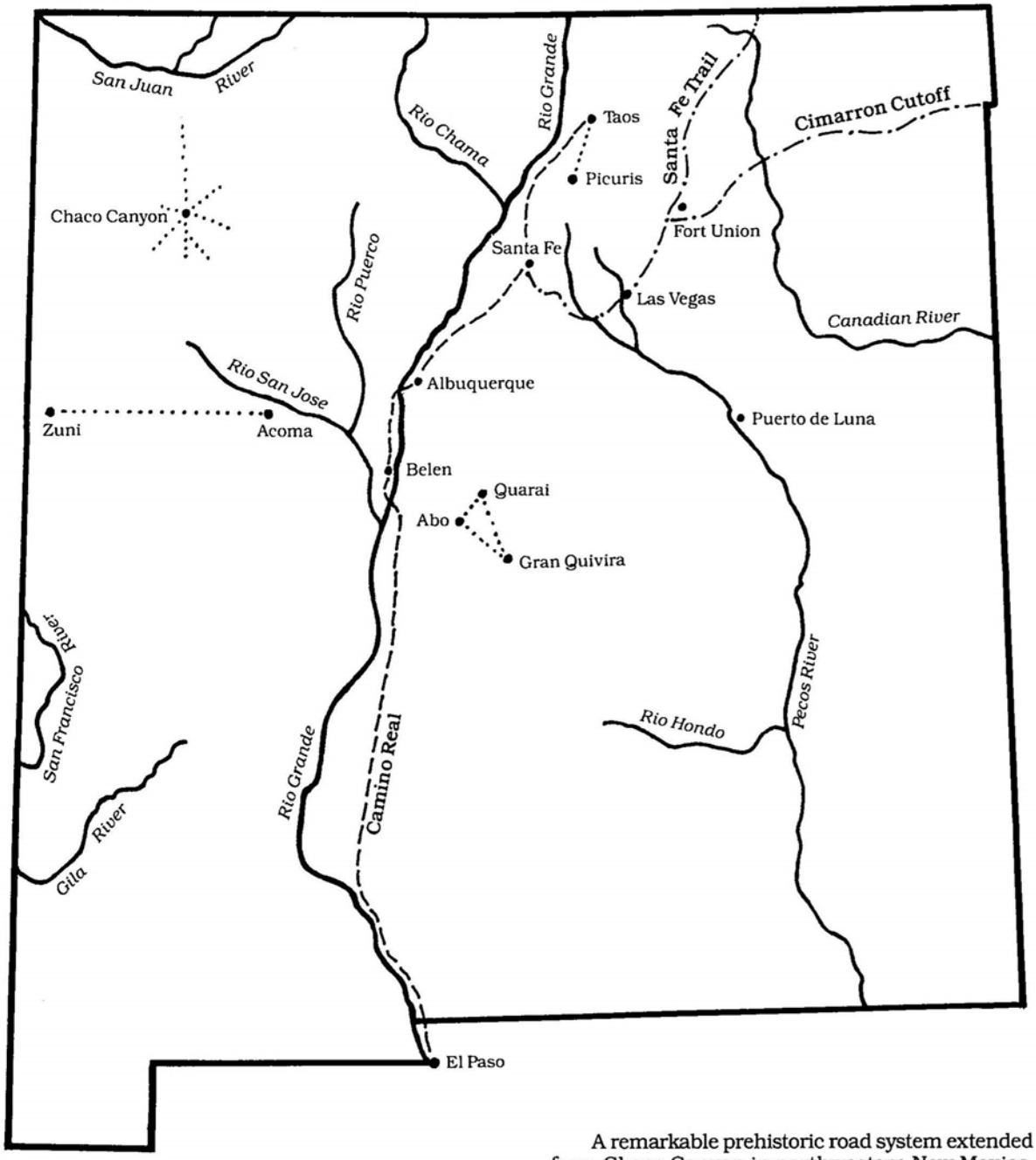


Fig. 1. **Timber Bridge Construction by the New Mexico State Highway Department** *(N.M. Highway Journal,* November 1923)



Legend

Prehistoric

Spanish

American Trade

A remarkable prehistoric road system extended from Chaco Canyon in northwestern New Mexico. Prehistoric roads and trails were also reported between Zuni and Acoma pueblos; Taos and Picuris pueblos; and, between Gran Quivira, Abo and Quarai.

The Camino Real was the most important Spanish route in New Mexico linking Taos, Santa Fe, Albuquerque and El Paso with Mexico.

American traders and goods entered New Mexico by way of the Santa Fe Trail. The Cimarron Cutoff was often favored in order to avoid the steep ascent over Raton Pass.

Fig. 2. **Prehistoric and Spanish Trails & Early American Trade Routes**

HISTORICAL OVERVIEW OF ROAD AND BRIDGE CONSTRUCTION IN NEW MEXICO TO 1956

Prehistoric Period

From prehistoric times to the present, improved methods of transportation have been a part of cultural change in New Mexico and a measure of the state's development. Archaeologists studying the San Juan Basin of northwestern New Mexico continue to find impressive evidence of an extensive road system built in Chaco Canyon probably between A.D. 1075 and 1140. This early effort to improve travel and communication between Indian pueblos marks the beginning of a long heritage of road and bridge building in New Mexico to meet the needs of a gradually expanding population.

The Chacoan road system represents a remarkable achievement by prehistoric peoples. With Pueblo Bonito, the largest and perhaps most important village, serving as a hub, a network of road systems, some more than forty miles long, linked settlements and sites in the San Juan Basin. Since the roads generally follow straight lines, authorities believe that an engineering plan or survey, perhaps using distant features on the horizon or even celestial bodies as reference points, preceded actual construction.[1] Considerable physical evidence remains to suggest that these roads were not

Fig. 3. **Taos Pueblo Footbridge.** Similar bridges of hand-hewn logs are still in use at Taos Pueblo. *(Marvels of the West* by William Thayer, 1888)

merely well-worn paths, but a built system with roadways 26 to 39 feet wide and with borders formed of sand and rock. Whatever may have been the specific functions of the road network, the Chacoans clearly were able to move more readily from place to place and to influence a larger territorial area.[2] (Figure 2)

The historical and archeological record confirms the existence of other prehistoric roads in New Mexico. Swiss-born anthropologist Adolph F. Bandelier found evidence during the late nineteenth century of a primitive road linking the Zuni and Acoma pueblos in western New Mexico, and he briefly reported on a trail between the Taos and Picuris pueblos. Apparently prehistoric Indians also used roads to open communication between the communities of Gran Quivira, Abo, and Quarai in the plateau region of central New Mexico. A similar pattern of roads and trails is recognizable between the pueblos located in the Rio Grande Valley.[3]

When those early inhabitants found it necessary to cross small streams, they utilized large, hand-hewn logs for the purpose. Indian foot bridges were commonly described by Spanish explorers in the sixteenth century. Casteñada, the historian traveling with Coronado's expedition in the early 1540s, reported that the Taos Pueblo was "built on both sides of the stream which was crossed by bridges constructed of very well hewn beams of pine timber."[4] (Figure 3)

Larger streams, such as the Rio Grande and Pecos River, could not be spanned in this way, but were crossed during low flow periods or at narrow locations. However, Bandelier recounted an Indian legend about constructing a "feather bridge over the Rio Grande by floating long feathers of a parrot and a magpie".

> As soon as the plumes met over the middle of the stream, people began to cross on this remarkable bridge; but bad sorcerers caused the delicate structure to turn over, and many people fell into the river, where they became instantly changed into fishes. For this reason the Navajos, Apaches and some of the Pueblos refuse to eat fish to this day.[5]

Exploration and Settlement

Spanish exploration of New Mexico began in the 1540s with Coronado's expedition in search of the riches of mythical Quivera. In pursuit of that goal, he ordered the construction of a timber bridge across the Pecos River probably in the vicinity of Puerto de Luna. Narratives of the expedition state that Coronado's party included about 300 Spanish soldiers, 800 Mexican and Indian allies, and a variety of livestock. The party ". . . stopped in order to build a bridge for crossing [the river]. This was completed in four days with all diligence and quickness. Once finished, the entire army and livestock crossed the bridge."[6] Spanish expeditions during the 1580s seem to have established the first road in North America by Europeans. According to Lansing Bloom, an authority on early roads of the American Southwest, the Spaniards developed the Chihuahua Trail from northern Mexico into New Mexico. Governor Juan de Oñate followed the route when he established the first Spanish

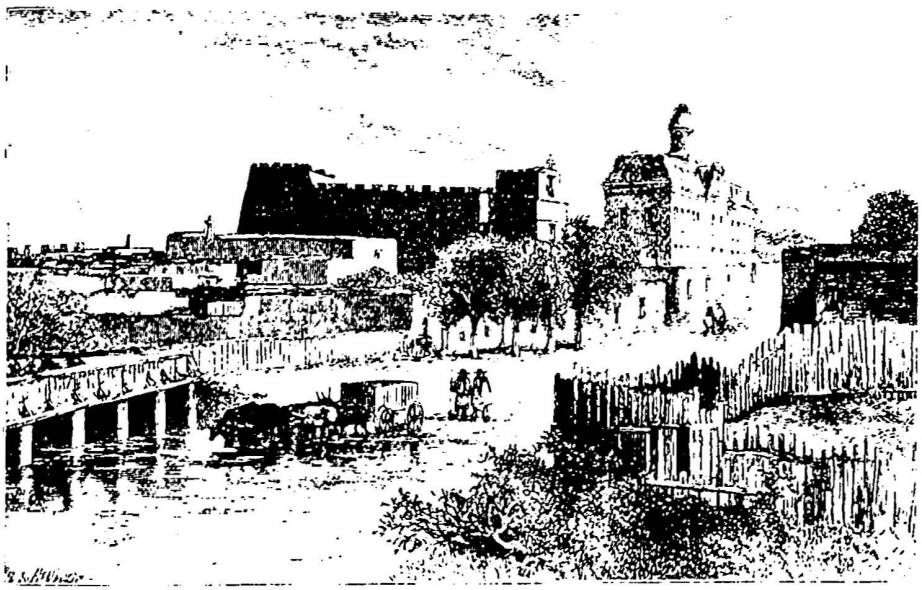


Fig. 4. **Santa Fe River Crossing.** This crossing was located near the end of the Santa Fe Trail in Santa Fe. *(Harpers Weekly,* July 14, 1883)

colony in New Mexico around 1598.[7]

Spanish administrators of colonial New Mexico placed a great emphasis on good communications and trade lines southward to Mexico City. They accomplished this through use of the Camino Real, the Royal Highway, that paralleled the Rio Grande and linked Taos, Santa Fe, Albuquerque, and El Paso with Mexico. The first recorded instance of Spanish bridge building appears in 1791 when colonial Governor de la Concha ordered the construction of a timber and stone bridge across the Rio Grande at Belen. In 1797 Spain built a bed of pine logs, reportedly over 500 feet long and 17 feet wide, to span the Rio Grande at El Paso del Norte. For a foundation, the bridge relied on wooden caissons filled with sand and rock and sunk into the river bed. Despite regular maintenance, both of these crudely constructed bridges repeatedly washed out and required rebuilding.[8]

Spain's emphasis on directing trade to the south from colonial New Mexico changed after Mexico achieved its independence in 1821. In that year Missouri traders opened an overland route to New Mexico known as the Santa Fe Trail. New Mexico authorities welcomed the arrival of American goods and encouraged regular trips into the province. Trade flourished. Lumbering Conestoga wagons made the slow and tortuous journey from Missouri through Kansas, where many chose to follow the Cimarron cutoff, near Dodge City, which avoided the steep ascent over Raton Pass into New Mexico. Beyond commerce, the Santa Fe Trail brought American influence into the region, and it proved to be an important military route at the outbreak of the Mexican War in 1846. American acquisition of New Mexico territory increased the value of the Santa Fe Trail and resulted in the construction of military posts to protect caravans from hostile Indians. The U.S. Army built Fort Marcy at Santa Fe during this period. Occasionally, in the later years of the Santa Fe Trail (1845-1870s), improvements along the route led to the building of short, primitive stone and timber bridges. Until the arrival of the railroad, the Santa Fe Trail remained the single most important commercial artery of New Mexico.[9] (Figure 4)

Territorial Period

The growing number of American settlers in New Mexico combined with the movement of goods and people across the region to Arizona and California to account for new road building during the early territorial period.

Fig. 5. **Bridge Across the Rio Grande at Albuquerque.** Some years after 1865, this 1600-foot bridge was built at Albuquerque. *(Illustrated New Mexico* by William Ritch, 1883)

The United States Army provided protection by erecting new military posts which were served by supply roads. In 1851 the Army made Fort Union, near Las Vegas, a distribution point for lesser posts within a 500 mile radius, while Albuquerque emerged as a supply center for quartermaster stores. During the 1850s military roads linked Taos and Santa Fe, Santa Fe and Las Cruces, Fort Union and Santa Fe, Cañada and Abiquiu, and Albuquerque and Tecolote.[10] For a short time (1858-1861), the Butterfield Overland Mail, the first transcontinental stagecoach service, used a route to California that traversed southern New Mexico, from Pope's Crossing on the Pecos River through El Paso, Mesilla, Fort Cummings, Shakespeare, and into Arizona.[11]

Despite these additions, post-Civil War New Mexico possessed only a rudimentary and fragmented road network. Stagecoach lines and freight wagons bumped along roads which were actually no more than deeply rutted paths worn into the surface by passing animals and carts. Transportation was somewhat easier along the Rio Grande where the old Spanish and Mexican trails remained in use. Bridges were rare. In February, 1865, however, the *New Mexico Press* announced, perhaps prematurely, the formation of an Albuquerque Bridge Company to span the Rio Grande with a toll bridge. The editor's delight was undisguised as he described the potential benefits.

> There are many pedestrians [who] cross the river every year, who would pay a few cents for crossing comfortably on a bridge rather than wade. Horsemen will pay to go safely over a bridge, rather than run the risk of missing shifting fords, or sticking in quicksands. Owners of carriages, carts

Fig. 6. **Timber Footbridge Across the Rio Grande at Santo Domingo Pueblo in 1880.** (Photograph by George C. Bennett, Courtesy of the Museum of New Mexico, Negative No. 2140)

> and wagons will pay to cross their vehicles by bridge, without delay, rather than subject themselves to the drawbacks and dangers of fording. Where communication is now weekly between Albuquerque and towns on the opposite side of the river, it will be daily and more frequent on the building of a bridge.[12] (Figure 5)

Bandelier reported that Indians at Santo Domingo in 1880 built a 400-foot long structure over the Rio Grande by sticking forked timbers into the riverbed to support a log footbridge; apparently it washed away a few months later.[13] As late as 1871 a stagecoach passenger told of a horseman riding ahead to find a suitable ford on the Rio Grande.[14] Thus, the arrival of the railroad in the territory at the end of the 1870s presented a superior means of transportation—as was true throughout the United States during the nineteenth century. (Figure 6)

New Mexico's railroad era began with the construction of the Atchison, Topeka and Santa Fe Railway south through Raton Pass to Las Vegas in 1879 and into Santa Fe and Albuquerque in 1880. At Isleta the Santa Fe Railway turned westward to Gallup and across Arizona to southern California. The railway also ran a line south along the Rio Grande to El Paso and Deming, where it joined the Southern Pacific building toward El Paso in the early 1880s. Other companies, such as the Pecos Valley Railway and the El Paso and Southwestern Railway, served farming, mining and logging areas and fed into the trunk lines. By 1910 the territory possessed an extensive railroad network that provided regional transportation as well as connections to all parts of the United States.[15]

With the advent of the railroads came sophisticated bridge building techniques. To a great degree the science of bridge building progressed with the nation's rail system which required structures capable of supporting heavy loads moving at relatively high speeds. Topographic and economic considerations in New

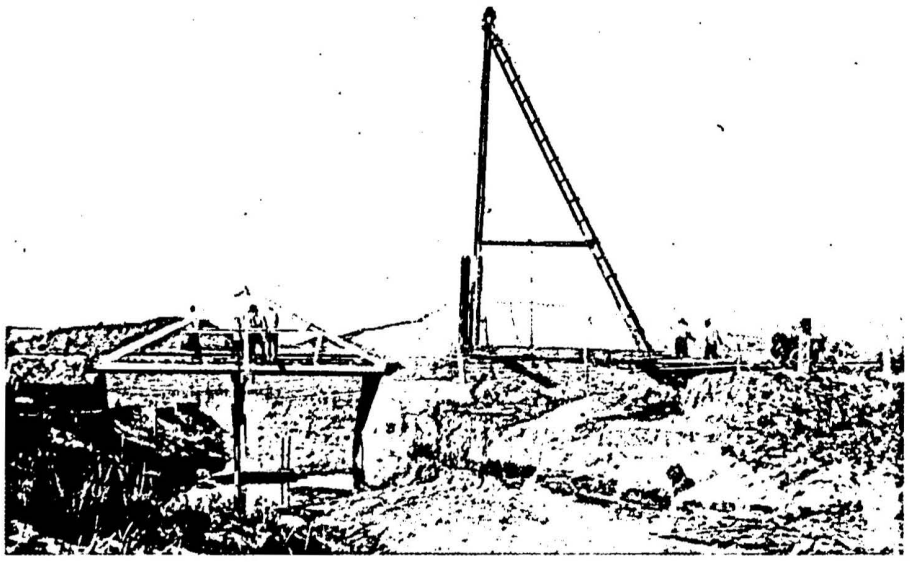


Fig. 7. **Timber King Post Truss Under Construction.** Early bridge building in New Mexico was limited to local projects such as this king post truss. (Highway Department Bridge Files, Inactive)

Mexico encouraged the construction of wooden trestles across major streams and over wide depressions. Timber trestles, sometimes two or more tiers high, could be quickly and cheaply erected from local sources of wood. For example, in 1899 the Alamogordo and Sacramento Railway built an unusual S-shaped trestle near Cloudcroft to serve the logging camps in the Sacramento Mountains. By the end of the century, however, the railroads of the territory were introducing iron and steel truss bridges for greater strength and durability.[16]

The dominance that steam-powered railroads enjoyed over the nation's transportation system at the turn of the century did not go unchallenged. A "bicycle craze" began in the East during the 1880s and 1890s and rapidly spread to other parts of the country, creating a demand for more and better roads among middle class bicyclists who wished to tour the countryside. Farmers also pressed for road improvements, in some cases to reach the railroads and in others to reduce their dependence on the "iron horse". Rural people generally sought better postal services and so favored the upgrading of country roads. These various interest groups coalesced to form a Good Roads movement that urged upon government, at all levels, greater attention to road and bridge building. The appearance of the automobile in this period injected a potent new force into the public debate about road improvements.

In 1904 Territorial Governor Miguel Otero purchased the first official automobile and one of the first motor vehicles in New Mexico. That same year the U.S. Office of Public Roads, a division within the Department of Agriculture, compiled road statistics for all the states and territories. The tabulation showed New Mexico with a total of 15,326 miles of road, or 12 miles per capita of population, but only 2 miles of improved road (0.01 percent of total mileage), and the territory spending $10.80 per mile, the fifth lowest in the nation. With the horseless carriage swiftly changing from plaything to necessity, New Mexico and the nation were forced to confront the challenges of the automobile age. Yet immediate responsibility for road improvements generally lay with local government, principally the county.[17] (Figures 7 & 8)

The sparse population and low tax revenues in New Mexico counties meant little activity in road and bridge construction. Simple, locally-made timber beam bridges existed in many places, but citizens proved reluctant to spend larger sums of money to purchase manufactured iron bridges. Structures of this kind were available from salesmen representing distant bridge companies, frequently located in the Middle West, that prefabricated iron or steel truss bridges and sold them through catalogs to county governments. The size, design, and price depended on sometimes vague specifications drawn up by local officials unfamiliar with bridge building. Later, many professional engineers were highly critical of these structures, claiming they were cheaply built, improperly aligned, and unsuitable for traffic loads. However, an important survivor of this period is the Rio Hondo Bridge at

Fig. 8. **Timber Truss Across the Rio Grande at Espanola About 1912.** (Photograph Courtesy of the Museum of New Mexico, Negative No. 61684)

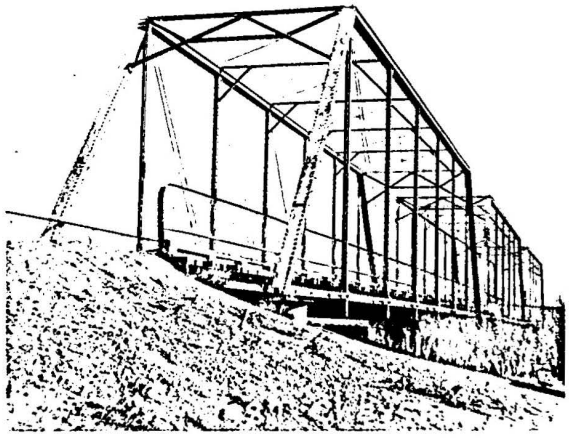


Fig. 9. **Pecos River Bridge at Roswell.** Originally constructed in 1902, a single span was moved to its present site over the Rio Hondo (No. 3452) after 1938. (Highway Department Files, Inactive)

Picacho (No. 3452). Originally constructed in 1902 by the Midland Bridge Company as part of a Pratt through truss bridge over the Pecos River at Roswell, a single span was moved to its present site after completion of a new bridge across the Pecos in 1938. In general counties tried to avoid the expense of manufactured bridges. Similarly, roads received minimal maintenance and were rarely planned to tie into a system for long distance travel.(Figures 9 & 29)

Under these circumstances, the territorial government conducted several small projects between 1903 and 1909 to improve roads by authorizing the use of prisoner labor. In 1905 prisoners upgraded the old Camino Real. Prompted by demands for greater efforts, in part arising from the Good Roads movement and the hope of increasing automobile tourism, the legislature in 1909 created a Territorial Roads Commission, consisting of the Governor, the Commissioner of Public Lands, and the Territorial Engineer.[18]

The Roads Commission surveyed new routes, selected old roads for improvement, and undertook the building of new macadam, sand-clay, and gravel roads. Projects completed in 1909-1910 included a "scenic highway" from Raton to the Colorado state line, and roads between Roswell and Carrizozo, Silver City and Mogollon, and Santa Fe and Albuquerque. Numerous surveys became the basis for planning new roads between towns in the territory. At the end of 1910, the Commission reported the completion of over 150 miles of new roads, improvements on 200 miles more, and plans for 500 miles of future road construction.[19]

With an increasing amount of technical information available from the federal Bureau of Public Roads, the Territorial Engineer began to introduce a greater degree of coordination and uniformity in road and bridge building. After 1909, all county road and bridge projects costing $1,000 or more required the approval of the engineer, who was authorized to review all plans, specifications, drawings, and contracts issued by local officials. Under this system, the Territorial Engineer examined and approved plans for a two-span concrete arch bridge over the Gallinas River at Las Vegas (No. 1549), and two steel truss structures across the middle Rio Grande, the Barelas Bridge and the Alameda Bridge. County bridges spanning the Vermejo River, the Canadian River at Maxwell, Raton Creek, the Pecos River at Carlsbad, the Penasco River, and Eagle Draw were also approved.[20] (Figures 10 & 51)

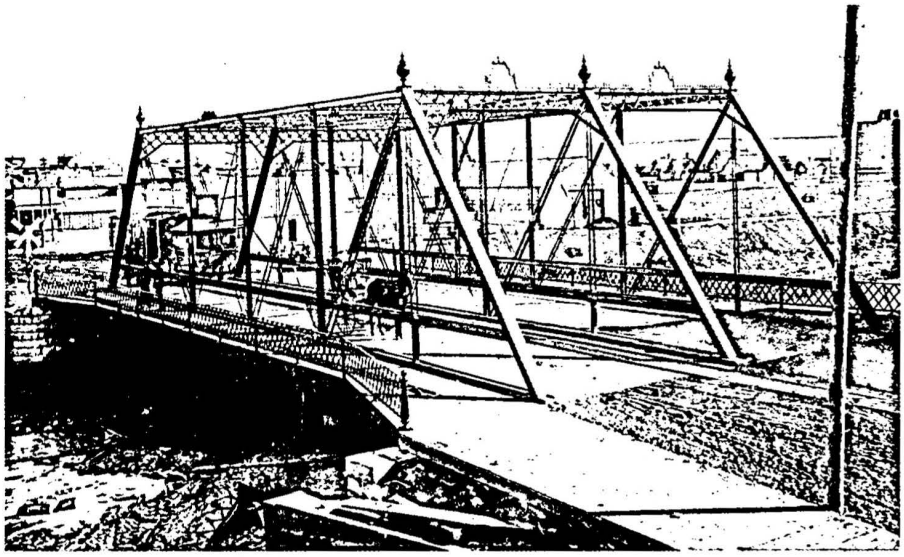


Fig. 10. **Steel Truss Bridge at Las Vegas.** This steel truss bridge was built over the Gallinas River about 1886 and was replaced in 1909 by the existing concrete arch bridge (No. 1549). (Photograph Courtesy of the Museum of New Mexico, Negative No. 56291)

Early Statehood

When New Mexico gained statehood in January, 1912, the state legislature quickly moved to organize a State Highway Commission on the framework of the territorial agency but with broader powers. A higher degree of participation by the state meant more attention to planning a statewide network of roads and to constructing highways and bridges with improved design, techniques and materials. The scope and difficulty of the task ahead were addressed by State Engineer James A. French:

> In its relation to traffic, the road situation throughout the state at the beginning of 1912 was deplorable; it was practically impossible to travel from county to county with any degree of comfort. Up to that time very little had been accomplished in systematic road building, due to the sparsely settled condition of the state, to the general misuse of county road funds, and to the lack of a central, or state, organization. Practically no inter-county road work had been attempted, construction having been confined to small stretches here and there, of purely local importance, with no thought of eventually connecting them to form a district or a state system. The standard of construction was poor, little or no attention being paid to proper drainage, and as a result many of these roads have been almost obliterated. As in many other states, the advent of motor-driven vehicles was probably the most important determining factor in the centralization of road-building in New Mexico and its prosecution along systematic lines.[21]

French attacked New Mexico's transportation needs with the vigor and determination that marked his administration of highway affairs. Between 1912 and 1916 the commission established the first state highways and, in cooperation with county road boards, designated main-traveled roads for improvement. The state legislature made available prisoner labor for road work and authorized road taxes and bond issues.[22]

During this four year period New Mexico acquired a state road system totalling more than 1,000 miles, including substantial improvement of the Camino Real between El Paso and the Colorado state line, and an extensive survey for future routes. Approximately 180 bridges were constructed, most (about 143) of which were inexpensive timber trestles, ranging from 5 to over 806 feet in length. These timber structures were generally used to span intermittent streams or shallow, broad waterways. Sturdier steel truss bridges appeared over perennial streams, across deep ravines and in flood-prone areas. These projects included a three span Warren through truss, 376 feet in length, over the Gila River at Cliff (No. 1382). Concrete construction varied from small slab structures to a four span arch measuring 160 feet in length built over the Canadian River near Springer. George E. Morrison, a civil engineer of East Las Vegas, supervised the design and construction of an unusual reinforced concrete truss over the Gallinas River between East and West Las Vegas in 1914. A number of these structures were later com-

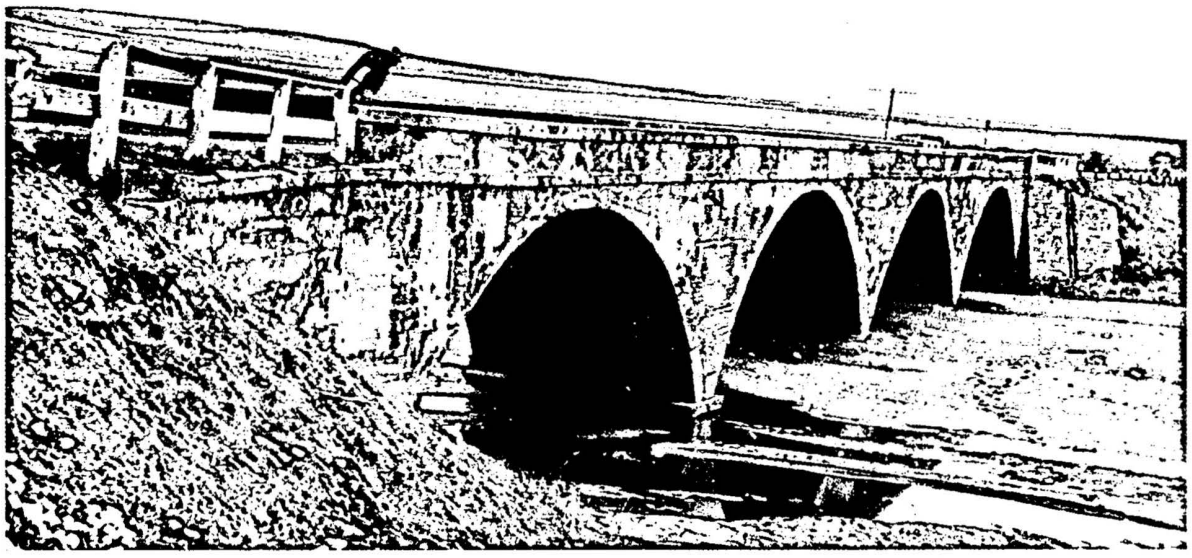


Fig. 11. **Canadian River Bridge near Springer.** Completed prior to 1916, this bridge was typical of the concrete arch construction used at several locations in the state. (Highway Department Bridge Files, Inactive)

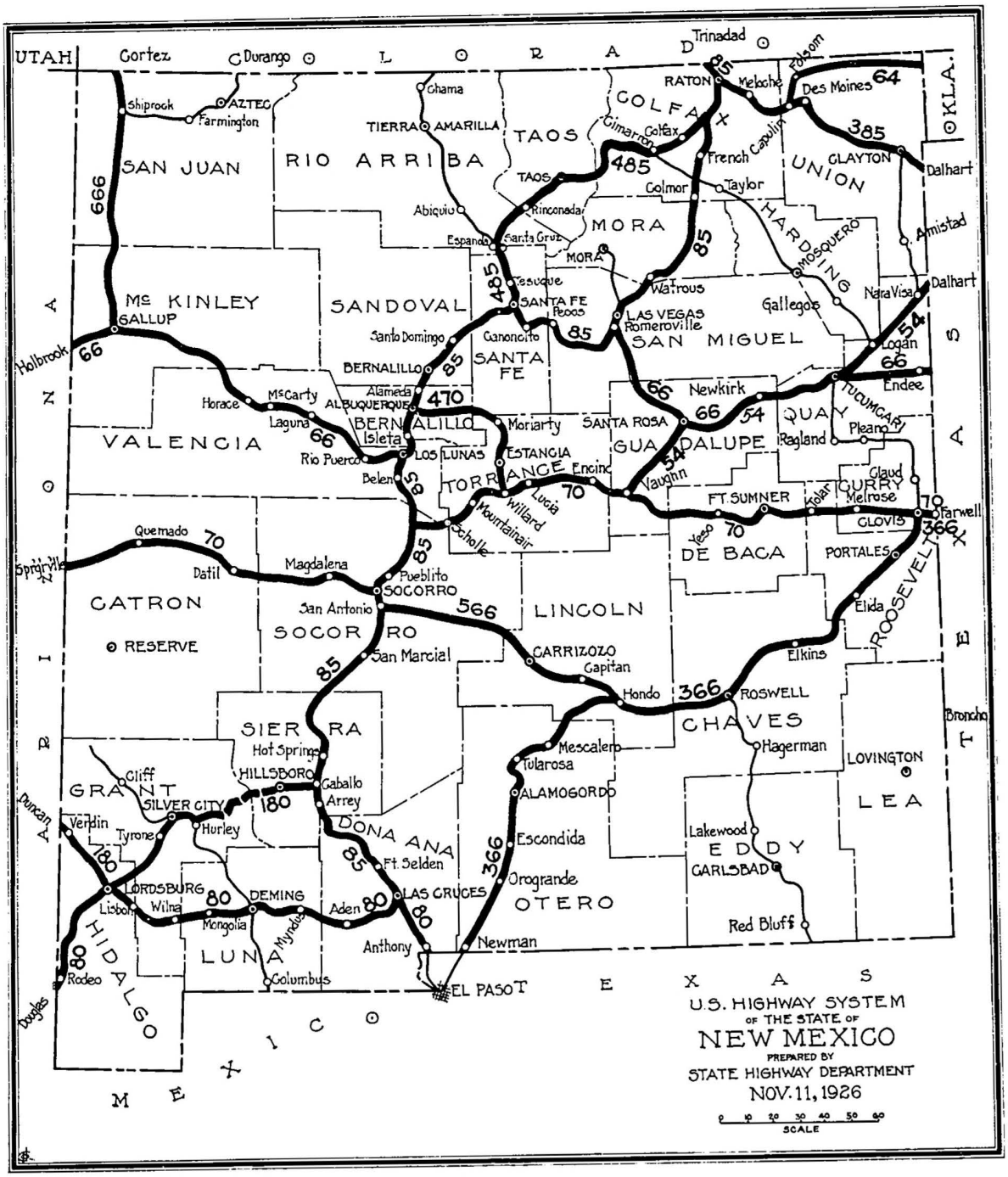


Fig. 12. **New Mexico Highway System in 1926.** This map includes the newly adopted Federal Highway Numbering System. *(N.M. Highway Journal,* March 1927, p. 14)

pleted by San Miguel County including the Variadero Bridge (No. 3964) over the Conchas River and the Isadora Bridge (No. 877) on Cuervo Creek.[23] (Figures 11, 39 & 55)

When conditions called for construction of a steel truss bridge, considerations of cost, portability, ease of erection and durability led in these early years of bridge building to a preference for the steel pony truss, with span lengths of 60 to 80 feet, set on wooden piers or on concrete or rock-filled metal cylinders. Kearny's Gap Bridge (No. 5507) is a representative structure. Designed by George E. Morrison but fabricated in Kansas, this Warren pony truss was erected about 1913.[24]

A new stage in road and bridge building began in New Mexico and the United States between 1916 and 1921. The rapidly growing number of automobiles accompanied by the more vocal demands of motorists for better roads convinced the federal government to assist highway construction in the states. The Federal Aid Road Act of 1916 authorized the Bureau of Public Roads to support state projects with matching funds. Although American participation in the First World War during 1917 and 1918 temporarily delayed this program, the failures of wartime transportation strengthened the argument for improved roads and demonstrated the critical need for long distance routes across state lines. At the end of the war, the federal government distributed to the states a large number of war surplus trucks, machines, and supplies that were converted to road building purposes. A supplemental road act in 1921 required the designation of a state highway system, totaling not more than seven percent of all state roads, to receive federal financial assistance.[25](Figure 12)

With its long distances and scattered population centers, New Mexico welcomed federal aid and made quick use of it. The first Federal-Aid Project (FAP) started in Colfax County in 1919-1920 to improve the roads and bridges between Raton and Ocate. This work, along the old Santa Fe Trail, included strengthening a two span truss bridge south of Raton and building several short reinforced concrete spans. The project typified the improvements begun by New Mexico with the costs divided between the county (25%), the state (25%), and the federal government (50%). The State Engineer's office prepared standard plans for surfacing roads with crushed rock or gravel and for constructing box culverts, abutments, and bridges. (Figure 13)

Progress during the 1910s and 1920s owed a great deal to the leadership of James A. French (1866-1926). Born in Washington, D.C., French achieved an excellent reputation as a civil engineer on numerous western projects, including the Elephant Butte Reclamation Project, prior to his appointment as State Engineer by Governor William McDonald in 1912. As State Engineer from 1912 to 1919 and State Highway Engineer from 1923 until his death, he personally directed the development of the early state highway system, sometimes working under difficult circumstances. In one instance, French and Governor McDonald, while on a road reconnaissance in 1914, had to row across the turbulent San Juan River at Shiprock to select a bridge site. In such ways he left his mark on the organization of the Highway Department, the evolution of a road system, and the technology of road and bridge building. It was not unusual for bridges in the era to bear a plaque stating that the structure had been designed or approved by James A. French,

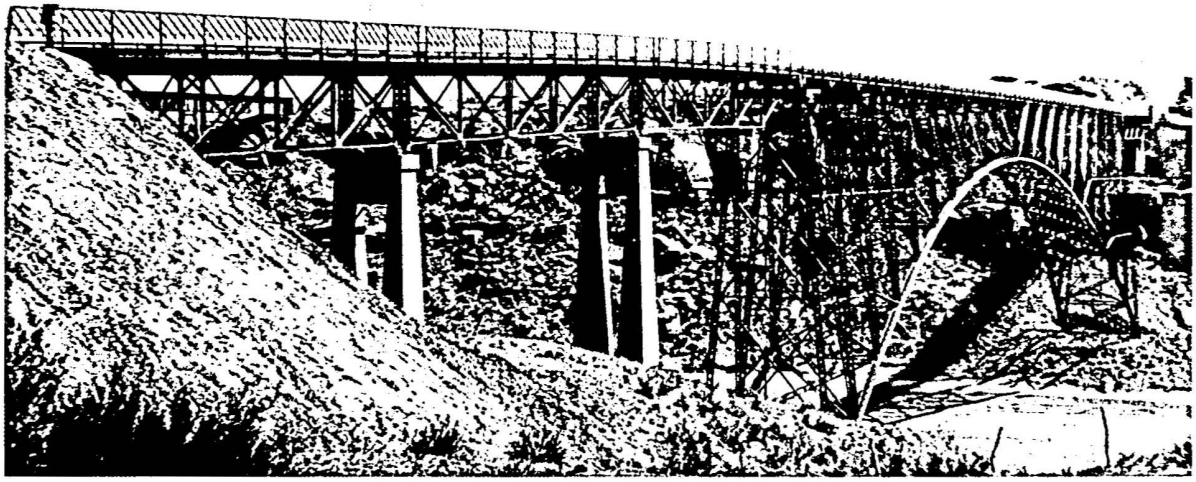


Fig. 13. **Canadian River Bridge at Logan.** This steel arch bridge was completed in 1922 as an early Federal-Aid Project. (Highway Department Bridge Files, Inactive)

THE BRIDGE BUILDER

Reprinted by Request
In Memory of
JAMES A. FRENCH

An old man, going a lone highway,
Came at the evening, cold and gray,
To a chasm vast and deep and wide.
The old man crossed in the twilight dim;
The sullen stream had no fear for him.
But he turned, when safe on the other side,
And built a bridge to span the tide.

"Old man," said a fellow pilgrim near,
"You are wasting your strength by building here;
Your journey will end with the ending day;
You never again will pass this way.
You've crossed the chasm deep and wide;
Why build you this bridge at evening tide?"

The builder lifted his old, gray head.
"Good friend, in the path I have come
There followeth after me today," he said,
"A youth, whose feet must pass this way.
This chasm, that has been naught to me,
To that fair-haired youth may a pitfall be;
He, too, must cross in the twilight dim.
Good friend, I am building this bridge for him."

—Anonymous.

Fig. 14. **James A. French (1866-1926).** (Photograph from *Report of the State Highway Engineer of New Mexico, 1916-1918*, Inside Cover; Poem from *N.M. Highway Journal*, October 1926, Inside Cover)

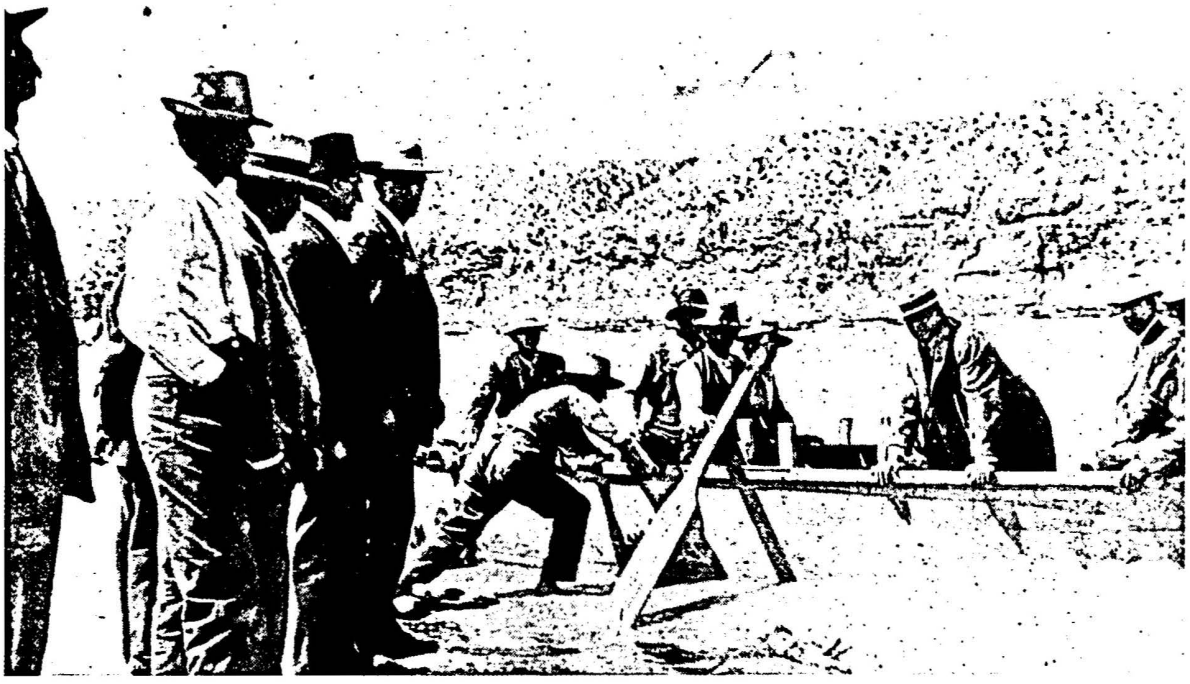


Fig. 15. **Road Reconnaissance Party Crossing the San Juan River near Shiprock in 1914.** State Engineer French is leaning on the side of the boat while Governor McDonald is seated just behind him. *(N.M. Highway Journal*, February 1932, p. 9)

for example, the Rio Felix Bridge (No. 357) of 1926.[26] (Figures 14, 15 & 33)

Bridges remained vital although problematical elements in the state's developing road system. Their technical complexity and cost made careful planning necessary in choosing sites, structural designs, and construction materials. In addition, the growing volume, weight, and speed of motor vehicles forced changes in bridge design and construction. State highway departments did receive some assistance on technical matters by the publication in 1926 of highway specifications approved by the American Association of State Highway Officials.[27]

Although known for its sunshine and dry climate, New Mexico actually presented bridge builders with some special problems. The major rivers in the state, such as the Rio Grande and the Pecos, required bridges, but so too did numerous intermittent streams and arroyos common throughout the southwestern United States. Dry most of the year, these ravines turned into rampaging, destructive waterways during heavy rainstorms. At such times structures built across them had to withstand "severe conditions" according to State Engineer W. J. Fulton in 1923. "The banks of the channel are continually sloughing and cloudbursts cause torrents which scour the beds to unbelievable depths. The height of the banks causes backfills and wings of such a nature that ordinary construction will not survive without prohibitive maintenance."[28] The concept of designing bridges capable of resisting occasional severe weather conditions, as favored by professional engineers, clashed with traditional practices of erecting lightweight and low-cost structures.

Flash floods took a heavy toll of New Mexico bridges and roads during the 1920s. District Engineer W. R. Eccles at Las Cruces reported extensive flood damage in the southwestern part of the state in late August, 1925. About ten inches of rain in four days caused the Rio Grande and Mimbres River to overflow their banks, washing away roads, bridges, and railway lines. Eccles used the occasion to recommend that bridge designers study the history of weather patterns and runoffs in dry areas hit by sudden and destructive rainstorms. In 1929 the flooding Rio Puerco washed bridges into the Rio Grande, which then propelled the debris downstream to batter and damage other bridges.[29] (Figure 16)

Despite these setbacks, New Mexico's bridge program progressed at a rapid rate during the 1920s. Timber continued to be a popular building material in this era. The state's large areas of broken terrain, arid climate, and modest tax revenues entered into the thinking of engineers who concluded that timber provided a strong, economical and readily available bridge building material, particularly well-suited for spanning smaller streams on secondary roads. The success achieved by western railroads in building large trestles out of timber treated with creosote preservative influenced the construction of highway bridges in New Mexico. The state built its first completely creosoted bridge in 1925 across the Rio Grande at Fort Selden, and over the next three years it erected more than a million dollars worth of creosoted bridges. The Texas Creosoting Company of Orange, Texas, appeared to be a major supplier of treated southern pine for bridges in New Mexico.[30] The design of treated timber bridges was later standardized by the Highway Department. (Figures 17 & 18)

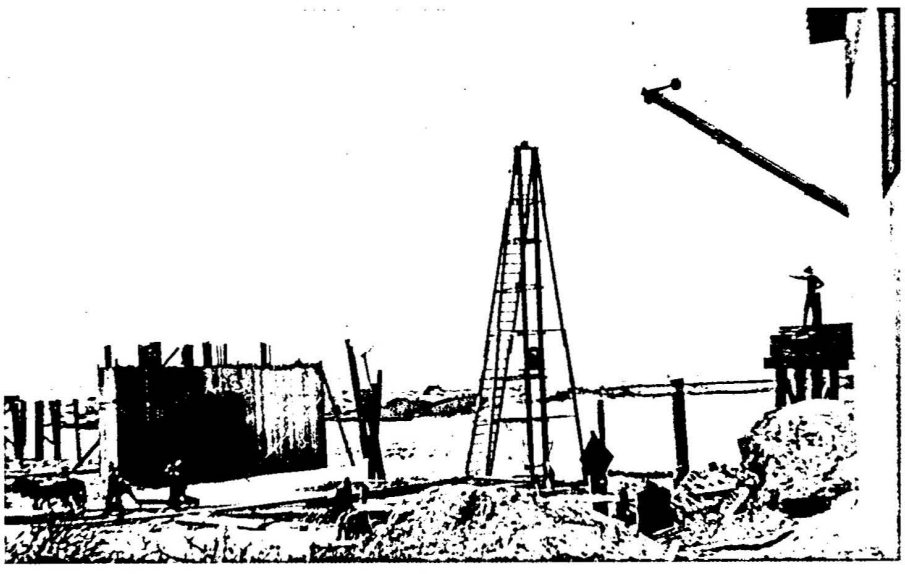


Fig. 16. **Rebuilding the Rio Puerco Bridge (No. 531) near Bernardo After the Flood of 1929.** (Highway Department Bridge Files)

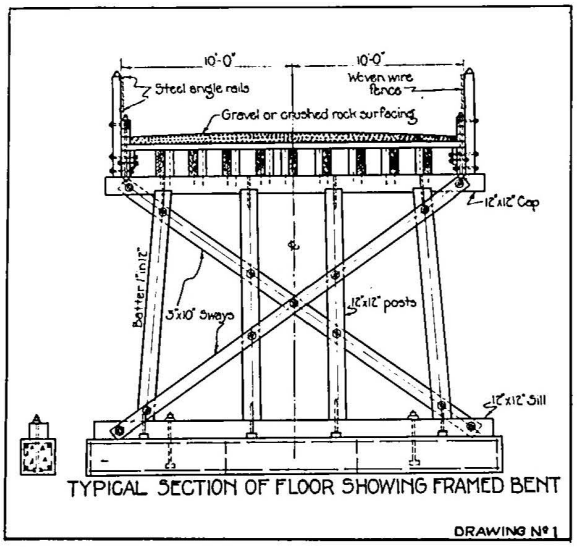


Fig. 17. **Treated Timber Bridge Design.** *(N.M. Highway Journal,* February 1928, p. 7)

While creosoting added years of life to a structure by resisting rot caused by the wetting and drying of wood, a timber bridge could also be more readily and cheaply lengthened or widened, even entirely replaced at lower cost, to meet changing conditions. The Highway Department preferred this flexibility since heavier and larger motor vehicles were forcing constant changes in the strength and roadway width of bridges. Compared to metal, timber was transported at lower cost, required fewer skilled workers and heavy machines to erect, and reduced the time for construction. State bridge engineer E. B. Van de Greyn in 1928 regarded the treated timber bridge a "natural choice" when acquiring a large number of bridges with limited funds. A surviving structure is the Rio Grande Bridge at Arrey (No. 1669), built in 1929, with 21 timber spans of 25 feet each.[31] (Figures 19, 20 & 60)

Suspension bridges, usually associated with major engineering efforts to span principal waterways and admired for their graceful configuration of towers, anchorages and cables, as found in the Brooklyn Bridge of 1883, appeared on a smaller scale in New Mexico after 1900. In the early decades of this century, engineers recognized the utility of shorter span suspension bridges to carry highway traffic, and many were built throughout the nation. Improvements in steel wire rope and better construction methods furthered interest in this design. A 232-foot suspension bridge built for San Juan County over the Animas River at Aztec prior to World War I apparently survived overloads and floods, convincing state highway engineers of the feasibility of this design for shorter spans. Even the failure of the Hagerman suspension bridge on the Pecos River in 1920 was believed due to an unusual overload by 200 stampeding steers, and not to any structural inadequacy. State Highway Engineer Lee W. Campbell thought the addition of stiffening trusses made suspension bridges safe and sturdy structures of particular value to New Mexico since their foundations could be set clear of the channel to reduce washouts. The 174-foot Otowi Suspension Bridge over the Rio Grande (No. 369), designed by Campbell and fabricated by the Kansas City Structural Steel Company in 1924, still stands as proof of the engineer's faith in this type of bridge. The Abiquiu suspension bridge was also completed as a State Highway Department project in 1924.[32] (Figures 21, 22 & 61)

In step with national trends during the first decade of this century, New Mexico made use of metal truss bridges for long and short spans. The through truss bridge, characterized by the traffic load on the bottom chord and truss sections on each side of the roadway, became the dominant form for spans over 100 feet. The pony truss, technically a through truss but without lateral bracing between the top chords, was a popular form for shorter spans. For its highway program, the state gen-

Fig. 18. **Cartoon Portraying Damage to a Timber Bridge by Unscrupulous Campers.** *(N.M. Highway Journal,* July 1923, Inside Cover)

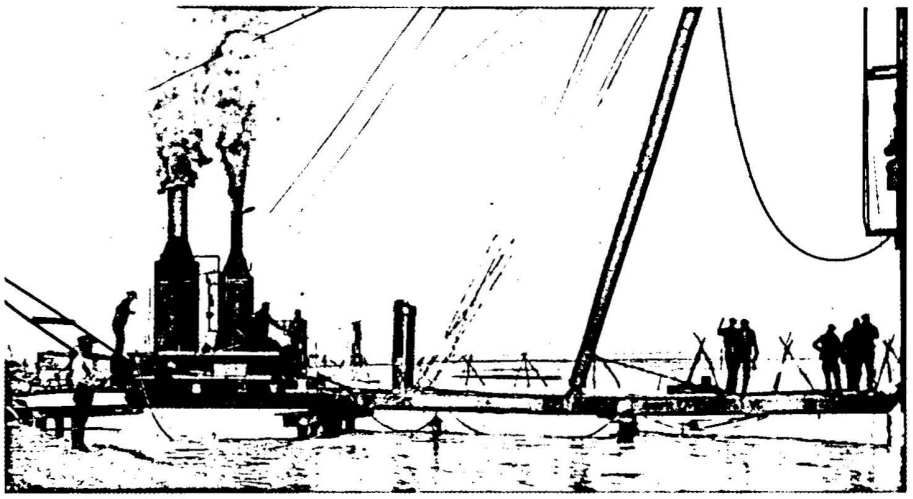


Fig. 19. **Driving Pilings During Construction of a Treated Timber Bridge Over the Rio Grande at Bernardo in 1931.** *(N.M. Highway Journal,* September 1931, p. 29)

erally chose Pratt and Parker designs for through truss construction; economics and function determining which type was selected for erection at a site. The Warren design was often chosen for early pony truss construction although the Parker design was preferred in later years. Numerous bridge companies were awarded contracts to design and fabricate bridges for New Mexico. Among the prominent firms were: the Missouri Valley Bridge and Iron Company of Leavenworth, Kansas; the Pueblo Bridge and Construction Company of Pueblo, Colorado; and, the Virginia Bridge and Iron Company of Roanoke, Virginia. No evidence exists of any New Mexico bridge fabricators.

Truss bridges became typical features on New Mexico's roads during the 1920s. The Rio Felix Bridge of 1926 (No. 357), a 432-foot three-span Pratt through truss utilized riveted construction for greater rigidity and strength. Several Parker types from the period have survived, including the 1921 Pecos River Bridge at San Jose (No. 1001), the Rio Hondo Bridge at Tinnie (No. 5272), originally erected in Bull Canyon in 1927, and the 1929 Animas River Bridge at Aztec (No. 119) that utilized Warren pony truss approach spans. The 1928 Animas River Bridge at Farmington (No. 401) employed a Warren truss for its 200-foot long main span. One of the larger projects in the 1920s resulted in a six-span, 815-foot steel truss bridge completed over the Pecos River at Fort Sumner in 1927.[33] This structure was replaced in 1958 after its lateral bracing and top chords were severely damaged by an overheight truck. (Figures 23, 33, 36 & 38)

Engineers of the 1920s steadily found new opportunities to use concrete as a building material on highway projects. Concrete's strength, permanence, and low maintenance appealed to engineers and, when the material was used in combination with steel, the range of construction applications expanded. The material performed well in bridge foundations, abutments, and culverts. In 1920 Santa Fe County constructed the Bridge of the Hidalgos (No. 701), the state's only concrete rainbow arch. The city of Santa Fe later built the Delgado Street Bridge (No. 4075) with concrete abutments, beams and deck. New Mexico's ef-

Fig. 20. **Revuelto Creek Bridge East of Tucumcari.** This bridge was completed on US 66 in 1931 using treated timber construction. (Highway Department Bridge Files, Inactive)

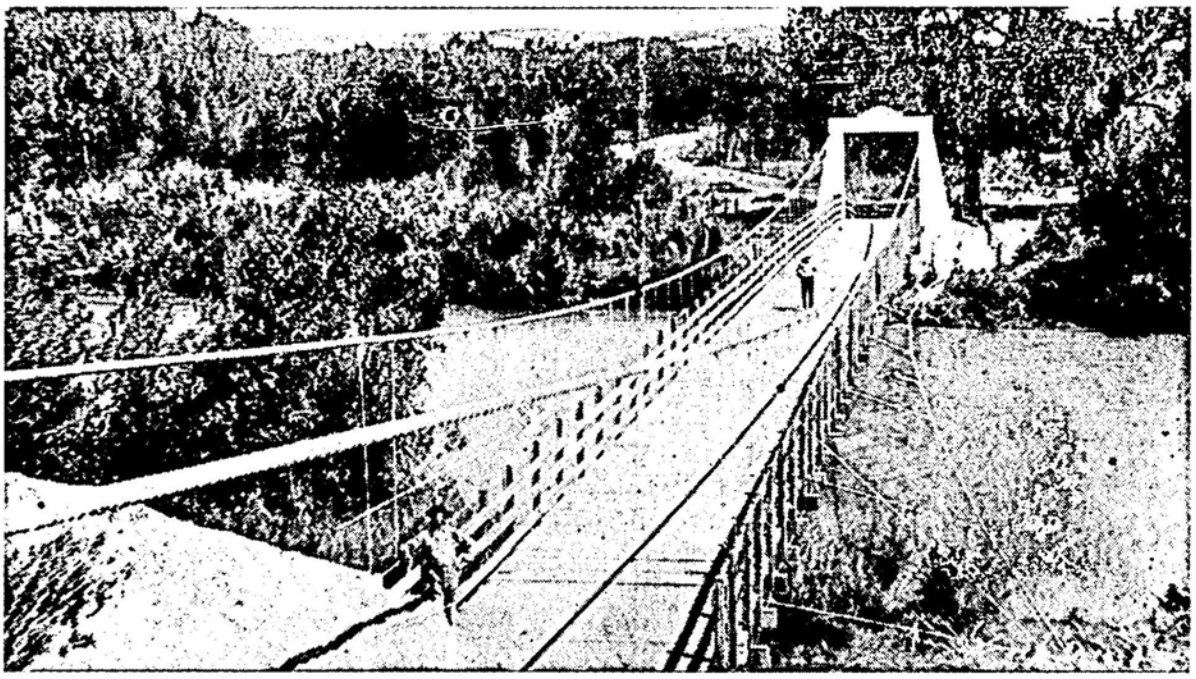


Fig. 21. **Aztec Suspension Bridge Shortly After Completion in 1908.** This bridge was the only structure across the Animas and San Juan Rivers to survive the disastrous flood of 1911. (Photograph Courtesy of the Aztec Museum)

fort to provide grade separations at dangerous railroad crossings generally depended on concrete abutments to support steel girders. Reinforced concrete piers, such as those used on a bridge at Cerrillos at 1928, provided a solid foundation for a superstructure of treated timbers. The state's federal aid program for 1928 revealed the increasing importance of concrete for bridge building: 22 bridges of creosoted timber, two of concrete beam construction, eight timber on concrete substructures, 12 steel on concrete foundations, and one combination of timber, steel and concrete. The last structure was the impressive Barelas Bridge erected at Albuquerque in 1928 replacing an earlier steel truss bridge at this site.[34] (Figures 24, 53 & 56)

The federal government also directly participated in road and bridge building through some of its agencies in the state. Beginning in the late teens and early twenties, federal funds were allocated to the Forest Service and the Bureau of Public Roads to develop transportation facilities in national forests. An early example of this activity is the Pecos River Bridge near Terrero (No. 239) in the Santa Fe National Forest. This unusual timber Howe through truss, 75 feet long, was built in 1921. The two-span Parker through truss completed in 1926 across the San Francisco River in Catron County (No. 599) has also been identified as a Forest Service project, with the structure built by the Salle Construction Company of Pueblo, Colorado. (Figures 35 & 58)

Better roads and bridges opened New Mexico to automobile tourists and campers from

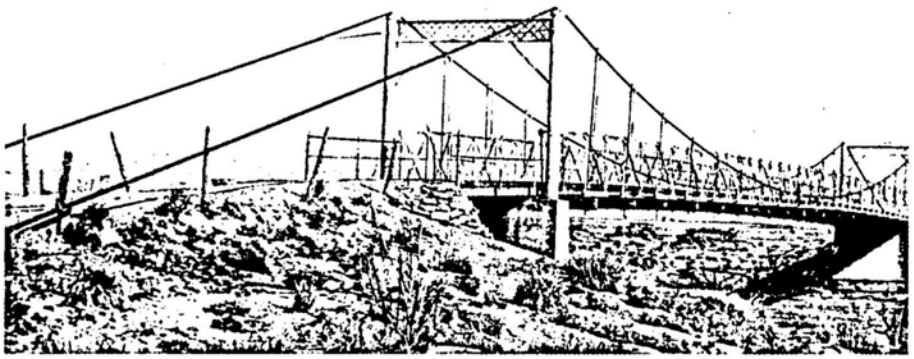


Fig. 22. **Lake Arthur Suspension Bridge Over the Pecos River.** This bridge was built as a county project about 1907 and served the area until its failure in 1956. (Highway Department Bridge Files, Inactive)

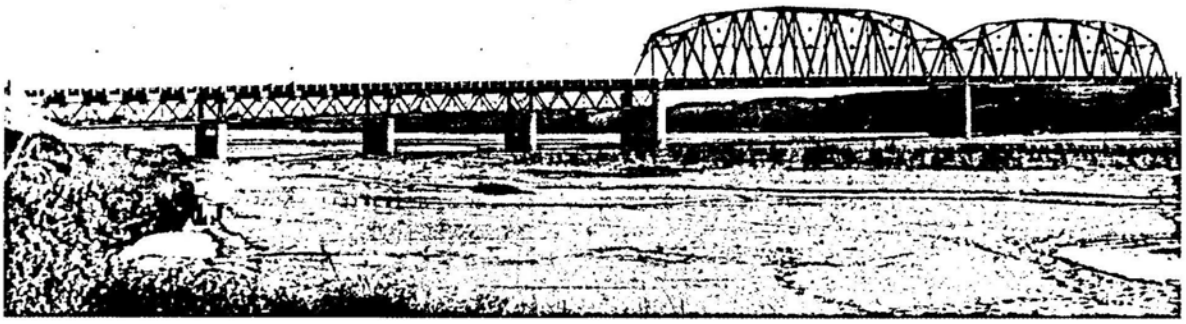


Fig. 23. **Pecos River Bridge at Fort Sumner.** Completed in 1927, the Pecos River Bridge included two through truss spans of 252 feet each and four deck truss spans of 75 feet each. *(N.M. Highway Journal,* September 1927, p. 8)

across the nation who came to enjoy the state's sunshine and natural beauty. In 1924 Santa Fe reported one hundred tourist cars entering the city each day. This lucrative trade emphasized a new truth about highways: the range of the automobile meant that never again could roads be viewed simply as local resources relying on local support. Rather, roads became the backbone of an integrated, statewide economy, which depended in part on the growing tourist industry. Realizing the need to raise revenue to match federal aid grants, New Mexico in 1919 became one of the first states to adopt a gasoline tax.[35] The *New Mexico Highway Journal* regarded gasoline consumption as a "meter of road use and road wearage" and sought more revenues from the "40% to 75% of cars from other states upon our highways." The same journal also reflected the value of tourism by featuring articles on the state's historical sites and scenic areas and promoting road improvements. In 1929 the Highway Department's Service Bureau published *The Roads to Cibola*, a lavish tour guide that used photographs and illustrations to attract visitors to the state.[36] (Figure 25)

The New Deal

However, the prosperity of the twenties did not last. Triggered by the stock market crash in October, 1929, the economy slumped into the Great Depression of the 1930s that quickly spread "hard times" to every corner of the nation. Yet fears that the depression would paralyze the highway and bridge program were never realized. Despite the deep and prolonged deflation, revenues produced by the gasoline tax remained surprisingly stable, indicating that the automobile had become a necessity to most people who continued to use the nation's highways. In fact, the Great Depression created a situation that resulted in new efforts to build and maintain highways. The federal government inaugurated a vast program of public works aimed at relieving the economic stress and providing jobs for the unemployed.

President Franklin D. Roosevelt's New Deal program, which began in 1933, allocated large sums of money to roads and bridges. The National Industrial Recovery Act provided federal financing without the customary state match and permitted urban streets and secondary roads to receive federal funds for the first time. The 52-foot long concrete arch bridge built in 1934 on Don Gaspar Avenue in Santa Fe (No. 3023) was a project of the National Recovery Municipal Program. Expenditures under the Emergency Relief Appropriation Act of 1935 made possible the construction of safer railroad grade crossings. State projects included underpasses on Central (No. 3116) and Tijeras (No. 6089) Avenues in Albuquerque and grade separations in Raton (No. 5492) and Fort Sumner (No. 2266), which generally used local contractors, laborers, and supplies. One study conservatively estimates that the federal government spent a billion dollars on road projects

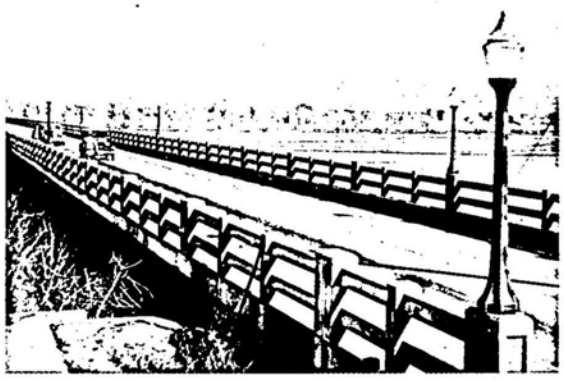
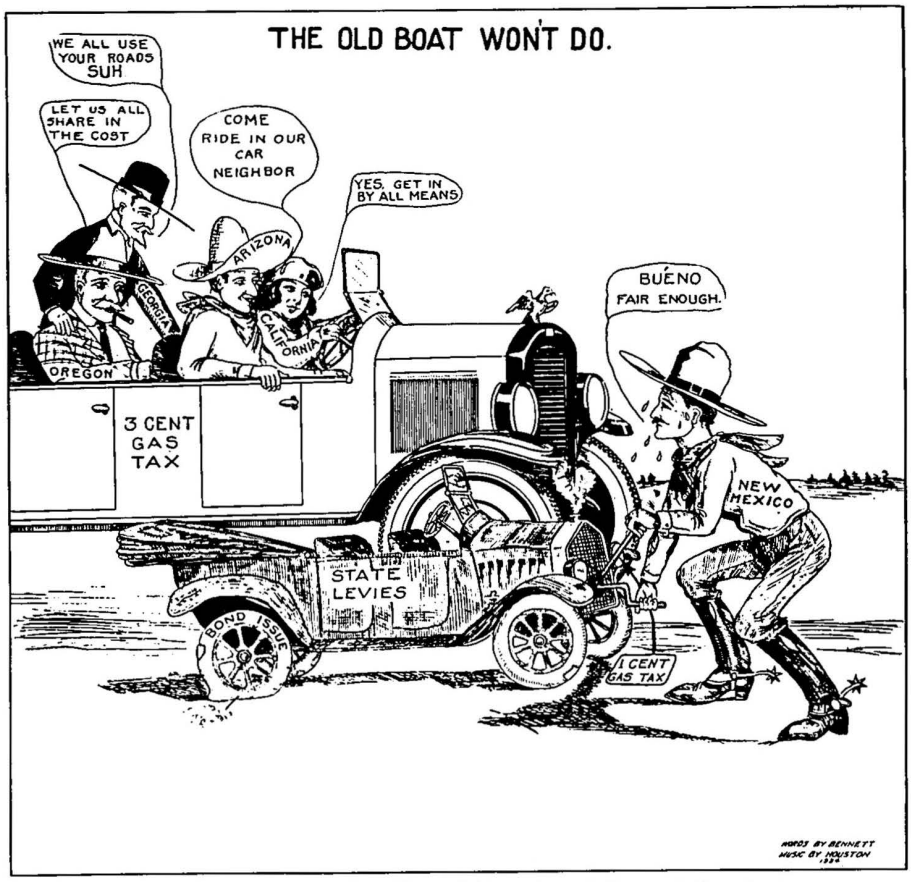


Fig. 24. **Barelas Bridge Across the Rio Grande at Albuquerque.** Completed in 1928, the Barelas Bridge included timber pilings, steel floor beams and a concrete deck. (Highway Department Bridge Files, Inactive)

between 1932 and 1938, improved 54,000 miles of road, and created hundreds of thousands of jobs. While criticized by some for their inefficiency and extravagance, these federal programs boosted road building across the country.[37] (Figure 26)

In the opinion of State Bridge Engineer E. B. Van de Greyn, the federal funds were sorely needed in New Mexico. He believed that many of the approximately 1,800 bridges in 1931 were inadequate to handle the weight of vehicles in the modern trucking industry.[38] The state devoted a portion of its federal money to strengthening or replacing older, deficient structures. One of the largest projects involved the construction of a six-span 1,007-foot long Parker through truss bridge over the San Juan River (No. 1792) at Shiprock in 1937 to replace a 1914-1915 structure. In some cases iron and steel trusses were moved to lighter duties or strengthened with new decks and beams. The Highway Department also added many concrete bridges and steel beam spans with reinforced concrete floors.[39] New steel beam bridges were built across the Alamosa River near Truth or Consequences (No. 1796) in 1937, the Pecos River at Roswell in 1938 which included twenty 75-foot long spans, and the Rio Grande at Española (No. 1836) in 1940. W. E. Bondurant Company of Roswell constructed an unusual timber bridge in 1940 near Truth or Consequences (No. 1831); the structure consisting of ten 25-foot long spans built on a curve in the highway. (Figures 27 & 50)

Federal aid for roads also reached New Mexico in other forms during the 1930s. The New Deal combined several relief programs to provide supplemental funds for road projects in agricultural areas stricken by severe drought. These Drought Relief Projects, known as NR-WR programs, improved roads in Curry, Quay, Harding, Lea, Roosevelt and Union Counties.[40] Federal agencies in the state, such as the Forest Service and the Bureau of Indian Affairs, continued to spend money on road and bridge building. In 1934, for instance, the Forest Service completed a deck truss bridge, containing a 122-foot long Warren main span, across the San Francisco River near Luna (No. 2211) in the Gila National Forest. The U.S. Bureau of Reclamation, working at Caballo Dam, constructed a timber span with concrete piers and abutments over Percha Creek (No. 2510) in 1937.



Get Behind a 3c Gas Tax for New Mexico

Fig. 25. **Cartoon Promoting an Increase in the Gas Tax for New Mexico.** *(N.M. Highway Journal*, October 1924, p. 13)

World War II

The outbreak of war in Europe in 1939 awakened Americans to the need for a strategic highway network to carry military personnel and supplies in the event of United States involvement in the conflict. Government reports concluded that, despite the progress made in the 1930s, the national road system remained deficient in many ways. Numerous bridges could not carry required loads, thousands of miles of highway did not meet standards, and many military installations and critical defense industries were isolated by inadequate roads. When America entered the Second World War in 1941, the federal government stressed defense highways, while deferring non-essential road projects. Access to defense plants and military camps received priority consideration throughout the war years.[41]

World War II halted the great era of road building that had begun after the First World War. Between 1940 and 1945, shortages of manpower, equipment, materials, and funds forced a curtailment of road construction, except for military necessity. Highway expenditures fell from a high of $2.6 billion in 1938 to a low of $1.6 billion in 1944.[42] Steel shortages led to greater use of concrete for bridges, and some states returned to timber construction. Assistance from the Defense Highway Act and other federal measures enabled New Mexico to build access roads to mines, timber lands, military installations, and airfields. The state's southeastern counties saw great activity because of defense plants and strategic resources in the area. Two major bridge projects were completed at Carlsbad during the war. Both the Bataan Memorial Bridge (No. 1838) and a 765-foot long timber span over the Pecos River provided better transportation to the valuable potash mines east of Carlsbad.[43]

Postwar Period

Since the Second World War, New Mexico's mixed economy of agriculture, natural resource development, federal establishments, defense industries, and tourism has required constant growth and improvement of the road network. The state initiated programs to replace and supplement older bridges, occasionally relocating metal trusses to lighter duties. The John Dunn Bridge (No. 5243), for example, an old Pratt through truss over the Rio Grande, was moved from Gallup in 1951. New bridge building during the late 1940s and 1950s sometimes possessed notable engineering and aesthetic

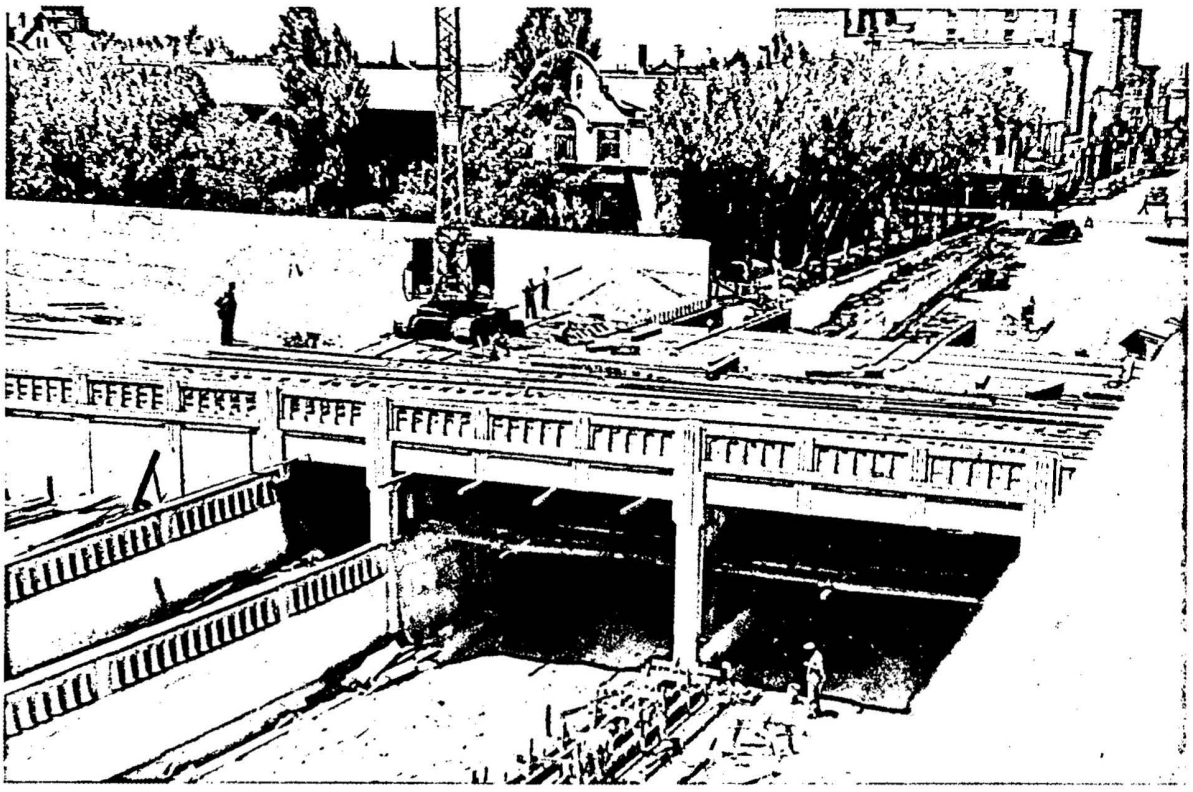


Fig. 26. **Central Avenue Underpass (No. 3116) During Construction in 1937.** The Alvarado Hotel and Downtown Albuquerque are shown in the background. (Highway Department Bridge Files)

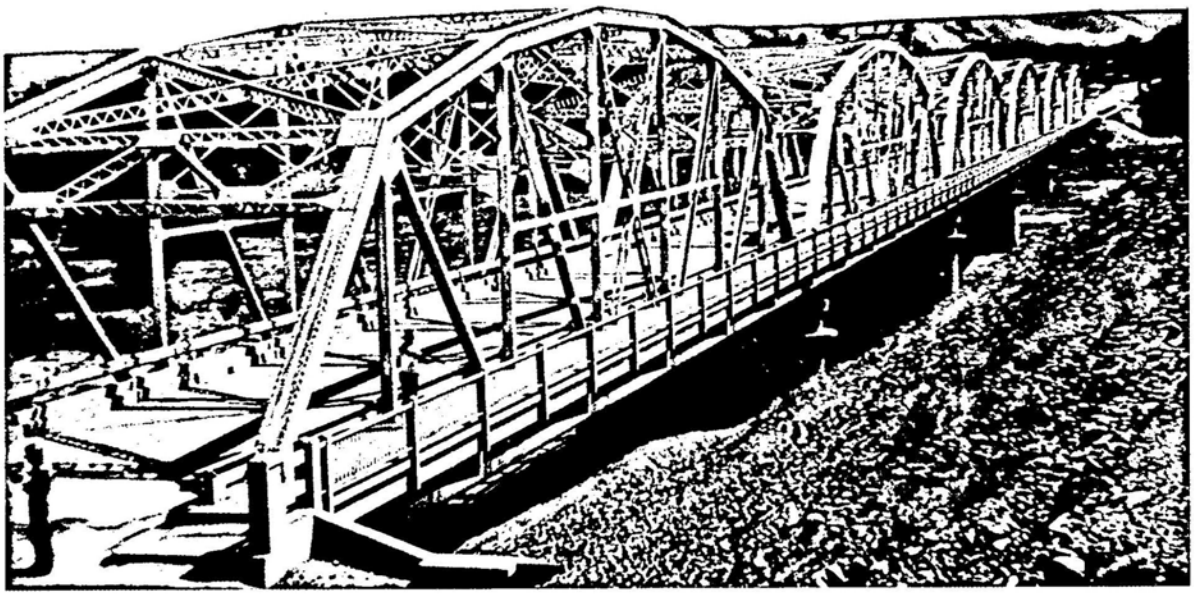


Fig. 27. **San Juan River Bridge at Shiprock (No. 1792).** The San Juan River Bridge at Shiprock was completed in 1937 and represents the high point of steel through truss construction in New Mexico. (Highway Department Bridge Files)

features. The Otowi Truss Bridge (No. 3469) completed in 1948 was the state's last new through truss bridge. It is an unusual one-span K-truss, an intricate design generally associated with the early twentieth century. The Los Alamos Canyon Bridge (No. 7622), an 820-foot long steel arch structure, is a good example of the larger projects completed to accommodate a growing volume of traffic. Concrete slabs and steel beams typically served the state's need for shorter spans.(Figures 34, 41 & 48)

Under President Dwight Eisenhower's administration in 1956 the federal government embarked on the most ambitious public works program ever attempted in the United States, a 41,000 mile Interstate Highway system, the first truly national, integrated network of roads. The Federal Aid Highway Act of 1956 established a Highway Trust Fund, its revenues drawn from user fees, that substantially increased federal participation in highway construction. New Mexico quickly responded to the program, letting contracts in 1956 and starting construction in 1957. Early plans envisioned 1,008 miles of Interstate Highways in the state. The first section of Interstate was completed ten miles east of Clines Corners along the route of old US 66. To reduce the cost of individual plans, bridge designs on the Interstate were often standardized and only slight design modifications were tolerated. Bridge construction relied on steel in combination with reinforced concrete slabs and precast concrete beams.[44] The initiation of the Interstate Highway System marked the beginning of a new era in highway and bridge construction for New Mexico.

Endnotes

1. U.S., Department of the Interior, Bureau of Land Management, *Chaco Road Project, Phase I: A Reappraisal of Prehistoric Roads in the San Juan Region*, edited by Chris Kincaid (Santa Fe: New Mexico State Office, Bureau of Land Management, 1983), pp. 3. 4-5, 13-14; 5. 26-27; 6. 26-29.

2. David G. Noble, ed., *New Light on Chaco Canyon* (Santa Fe: School of American Research Press, 1984), pp. 52-53.

3. Kincaid, *Chaco Roads Project*, pp. 2-3; Warren A. Beck and Ynez D. Haase, *Historical Atlas of New Mexico* (Norman: University of Oklahoma Press, 1969), pp. 20, 24.

4. Lansing B. Bloom, "Early Bridges in New Mexico," *New Mexico Highway Journal* 3, January 1925, p. 5. See also George P. Hammond and Agipto Rey, *Narratives of the Coronado Expedition* (Albuquerque: University of New Mexico Press, 1940).

5. Bloom, "Early Bridges," p. 5.

6. Bloom, "Early Bridges," pp. 5-6.

7. Lansing B. Bloom, "The Chihuahua Highway," *New Mexico Historical Review* 12 (July 1937): 213-215.

8. Max L. Moorhead, "Spanish Transportation in the Southwest, 1540-1846," *New Mexico Historical Review* 32 (April 1957): 120-121; Bloom, "Early Bridges," pp.7, 18-19.

9. Beck and Haase, *Historical Atlas*, pp. 20-27.

10. F. T. Cheetham, "El Camino Militar," *New Mexico Historical Review* 15 (January 1940): 5; Averam B. Bender, "Military Transportation in the Southwest, 1848-1860," *New Mexico Historical Review* 32 (April 1957): 148-150.

11. Beck and Haase, *Historical Atlas*, pp. 23-27, 34.

12. *New Mexico Press*, 7 February 1865.

13. Bloom, "Early Bridges," p. 5.

14. William S. Wallace, "Stagecoaching in Territorial New Mexico," *New Mexico Historical Review* 32 (1957): 207.

15. Beck and Haase, *Historical Atlas*, pp. 53-54, 58. A good overview of railroad development in the state is David F. Myrick, *New Mexico's Railroads: An Historical Survey* (Golden: Colorado Railroad Museum, 1970).

16. An important engineering accomplishment, the Cloudcroft Railroad Trestle is listed on the New Mexico State Register of Cultural Properties.

17. Oscar O. Winther, *The Transportation Frontier: Trans-Mississippi West, 1865-1890* (Albuquerque: University of New Mexico Press, 1974), pp. 157-160; E. Dana Johnson, "New Mexico's First State Automobile," *New Mexico Historical Review* 11 (January 1936): 1-3.

18. New Mexico, Territorial Engineer, *Second Biennial Report of the Territorial Engineer to the Governor of New Mexico* (1909-1910), pp. 143-147, 165-172.

19. Territorial Engineer (1909-1910), pp. 166, 173-187; U.S., Department of Agriculture, Office of Public Roads, *Mileage and Cost of Public Roads in the United States*, by J. E. Pennybacker and Maurice O. Eldridge, Bulletin No. 41 (Washington: Government Printing Office, 1912), pp. 28-29.

20. Territorial Engineer (1909-1910), pp. 143-148, 165-166; Bruce E. Seely, "Engineers and Government-Business Cooperation: Highway Standards and the Bureau of Public Roads, 1900-1940," *Business History Review* 58 (Spring 1984): 53-61.

21. New Mexico, State Engineer, *First Report* (July 12, 1912-December 1, 1914), pp. 13-14.

22. State Engineer, *First Report*, pp. 8-14, 18; U.S., Department of Agriculture, Office of Public Roads and Rural Engineering, *Public Road Mileage and Revenues in the Central, Mountain and Pacific States, 1914* (Washington: Government Printing Office, 1917), pp. xxi, 38-39.

23. State Engineer, *First Report*, pp. 8-14, 18, and 31-35; New Mexico, State Engineer, *Second Report* (December 1, 1914-November 30, 1916), pp. 26-29.

24. State Engineer, *First Report*, p. 32.

25. Jean Labutt and Wheaton Lane, eds., *Highways in our National Life* (Princeton: Princeton University Press, 1950), pp. 88-91; U.S., Department of Transportation, Federal Highway Administration, *America's Highways 1776-1976: A History of the Federal-Aid Program* (Washington: Government Printing Office, 1976), pp. 86-89, 104-106 .

26. *New Mexico Highway Journal*, October 1926, pp. 6-7; *New Mexico*, February 1932, pp. 9-11, 37.

27. Ellis L. Armstrong, Michael C. Robinson, and Suellen M. Hoy, eds., *History of Public Works in the United States, 1776-1976* (Chicago: American Public Works Association, 1976), pp. 115-116.

28. *New Mexico Highway Journal*, November 1923, pp. 3-4.

29. *New Mexico Highway Journal*, October 1925, pp. 17-18, and September 1929, pp. 19.

30. *New Mexico Highway Journal*, November 1923, pp. 3-4, and February 1928, pp. 7-9.

31. *New Mexico Highway Journal*, June 1925, pp. 13, 28, and February 1928, pp. 7-9.

32. *New Mexico Highway Journal*, October 1923, p. 5, August 1924, p. 27, and September 1924, pp. 6-7, 33; J. A. L. Waddell, *Bridge Engineering*, Vol. I (New York: John Wiley, 1916), p. 647.

33. *New Mexico Highway Journal*, January 1925, p. 11, April 1925, pp. 4, 25, and September 1927, pp. 6-8.

34. *New Mexico Highway Journal*, June 1924, p. 11, July 1924, front cover, and November 1928, p. 12; Department of Transportation, *America's Highways*, p. 428.

35. *New Mexico Highway Journal*, September 1924, pp. 2, 8; John C. Burnham, "The Gasoline Tax and the Automobile Revolution," *Mississippi Valley Historical Review* 48 (December 1961): pp. 441-442.

36. *New Mexico Highway Journal*, September 1926, pp. 13-14, November 1928, pp. 8, 17, and August 1929, p. 26.

37. Department of Transportation, *America's Highways*, pp. 123-126.

38. *New Mexico Highway Journal*, December 1931, pp. 34-35, and June 1932, pp. 36-38, 41.

39. New Mexico, State Highway Engineer, *Biennial Report* (1937-1938), pp. 12-14; *New Mexico*, February 1933, pp. 18-19, 43.

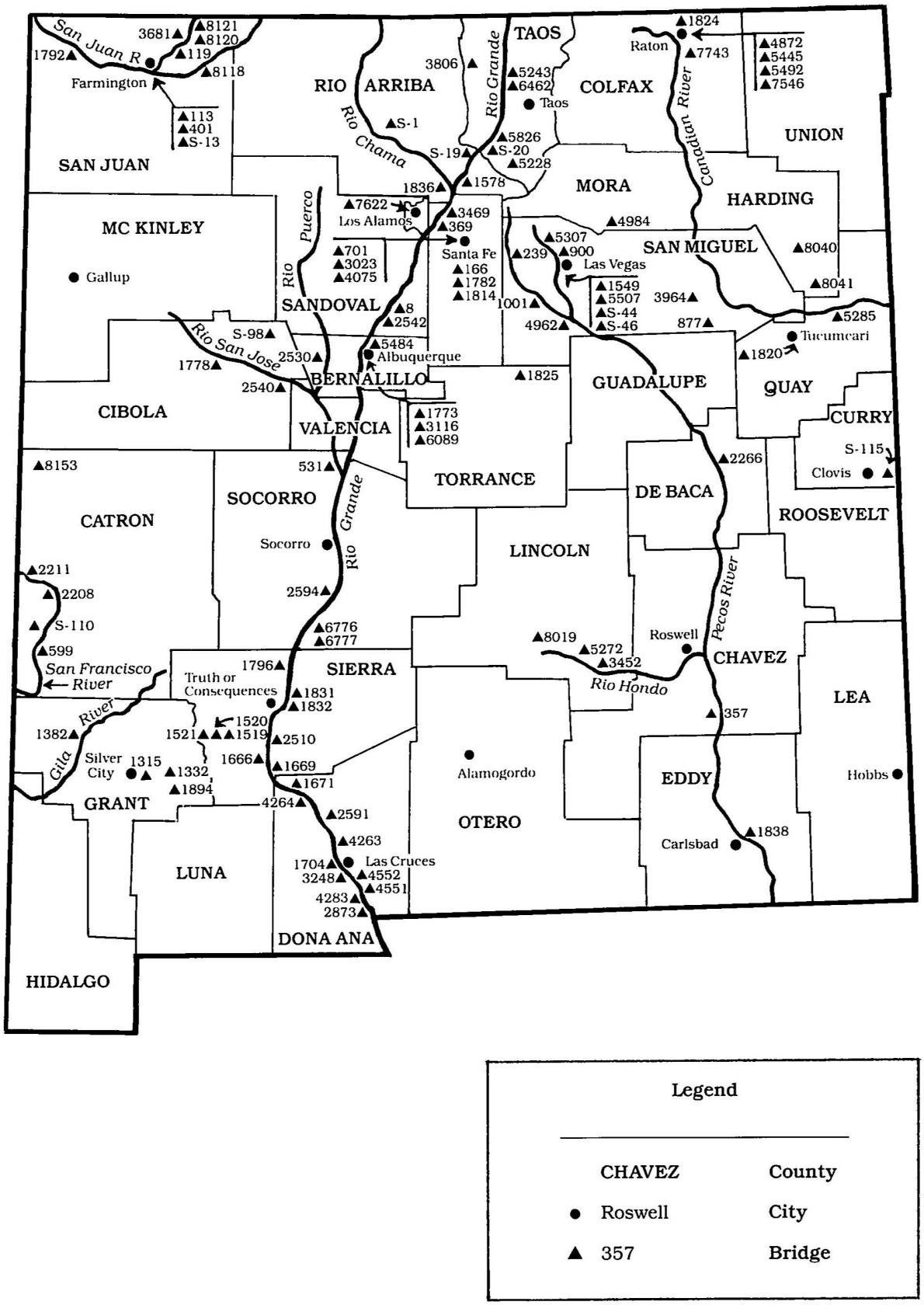
40. Armstrong, *History of Public Works*, pp. 84-85; Department of Transportation, *America's Highways*, pp. 142-149.

41. Department of Transportation, *America's Highways*, pp. 144-145.

42. James E. Flink, *The Car Culture* (Cambridge: MIT Press, 1976), p. 189.

43. New Mexico, State Highway Engineer, *Biennial Report* (1943-1944), p. 10; *New Mexico*, June 1942, p. 28, August 1942, p. 30, and February 1945, p. 28.

44. *New Mexico*, February 1957, p. 41, September 1958, pp. 38-39, and October 1958, pp. 36-37.

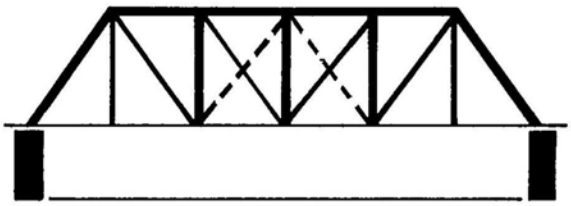


Legend	
CHAVEZ	County
● Roswell	City
▲ 357	Bridge

Fig. 28. **Location of Recorded Bridges**

BRIDGE TYPES AND RECORDED EXAMPLES

The following 100 bridges have been recorded in the New Mexico Historic Bridge Survey. The recorded bridges are listed by bridge type in order to identify the surviving number of bridges of each class and to allow for comparisons to be made of similar structures. Forty of these bridges, each identified by an asterisk, were selected for their exceptional historical and engineering qualities and their potential eligibility for the National Register of Historic Places.



Pratt Through Truss, Pinned Connections

The Pratt truss was patented in 1844 by Thomas and Caleb Pratt and became one of the most widely used truss designs of the late 1800s and early 1900s in the United States. The Pratt design is characterized by its diagonal members acting in tension and its vertical members acting in compression.

Pinned connections were used for the light-weight Pratt through truss bridges constructed in New Mexico around the turn of the century. Steel rods or bars served as the diagonal tension members of these bridges. Lattice beams composed of two steel channels joined with riveted bracing served as the vertical compression members.

Pratt through truss bridges with pinned connections were among the first "engineered" bridges used in New Mexico and were usually constructed as county or municipal projects. The bridge members and connections were made by bridge fabrication companies using standard designs. These bridges were often erected by bridge construction companies under contract to the county or municipality. Because of their light-weight members and pinned connections, the early Pratt through truss bridges were comparatively easy to erect

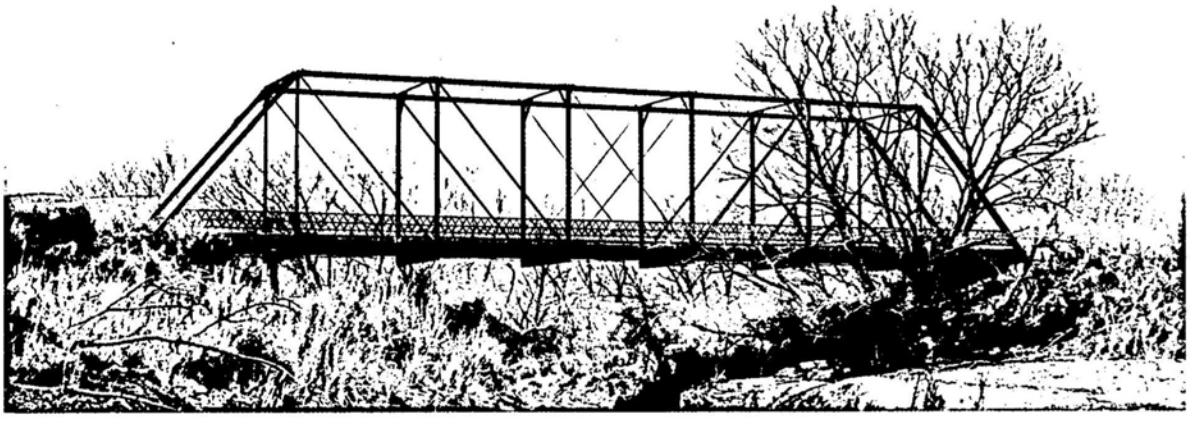


Fig. 29. **Rio Hondo Bridge at Picacho** (No. 3452)

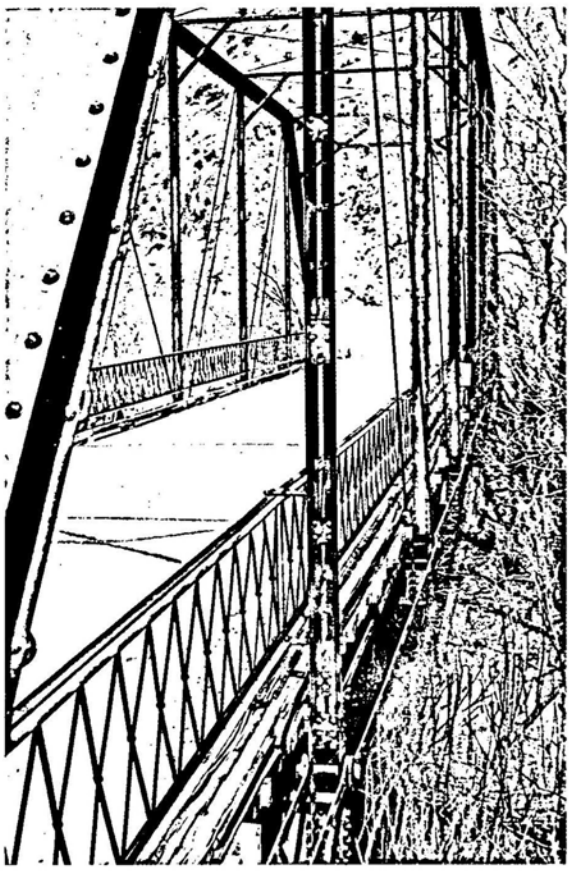


Fig. 30. **Detail of Rio Hondo Bridge** (No. 3452)

and could be moved from site to site as conditions required.

There are now only four Pratt through truss bridges constructed of light-weight members and pinned connections remaining in New Mexico. One additional Pratt through truss with pinned connections constructed for railroad use remains over the Gallinas River near Montezuma, New Mexico. When the railroad was abandoned, this bridge was converted for vehicular traffic.

Rio Hondo Bridge*
No. 3452
County Road A-4 at Picacho
Lincoln County

The Rio Hondo Bridge at Picacho was one of three spans originally built in 1902 over the Pecos River, east of Roswell. It is believed to have been fabricated by the Midland Bridge Company and moved to its present location during the late 1930s. This bridge is a Pratt steel through truss with pinned connections. It consists of seven 19-foot panels and has a total length of 133 feet. Riveted steel lattice beams are used for its vertical members. Rectangular steel bars and steel rods are used for its diagonal members. The decorative steel guardrail appears to have been part of the original bridge construction.

The Rio Hondo Bridge is located on an unpaved county road just off US 70 between Roswell and Ruidoso. The setting is in the rural Hondo Valley which is very appropriate for this early truss. The Rio Hondo Bridge is the longest Pratt truss span with pinned connections remaining in New Mexico and it is also the oldest documented steel truss bridge in the state. (Figures 29 & 30)

Cold Spring Canyon Bridge*
No. 1894
County Road B-13
near San Lorenzo
Grant County

The Cold Spring Canyon Bridge is a Pratt steel through truss with pinned connections. It has a total length of 80 feet provided by five 16-foot panels. This bridge includes a timber deck and a 12- foot roadway.

According to its nameplate, the Cold Spring Canyon Bridge was fabricated by the El Paso Bridge and Iron Company in 1908. This bridge is now used on a county road to span a small rock canyon located east of the Mimbres River. This bridge is one of the earliest steel through trusses remaining in New Mexico.(Figures 31 & 32)

Gallinas River Bridge*
No. 5307
NM 65 near Montezuma
San Miguel County

After the arrival of the Santa Fe Railway in Las Vegas in 1879, an eight-mile branch line was constructed up the Gallinas Canyon to carry passengers to the Hot Springs and Montezuma Hotel. A series of ponds were also developed in the canyon for supplying ice for the Santa Fe Railway and Fred Harvey hotel and restaurant system.

The Gallinas River Bridge was originally constructed in 1919 as a railroad bridge on the Hot Springs branch line. It replaced an earlier timber truss railroad bridge built prior to the opening of the line in 1882. Since the abandonment of the Hot Springs line in 1937, the bridge and part of the old railroad grade have been used for vehicular traffic. The route is now designated as NM 65.

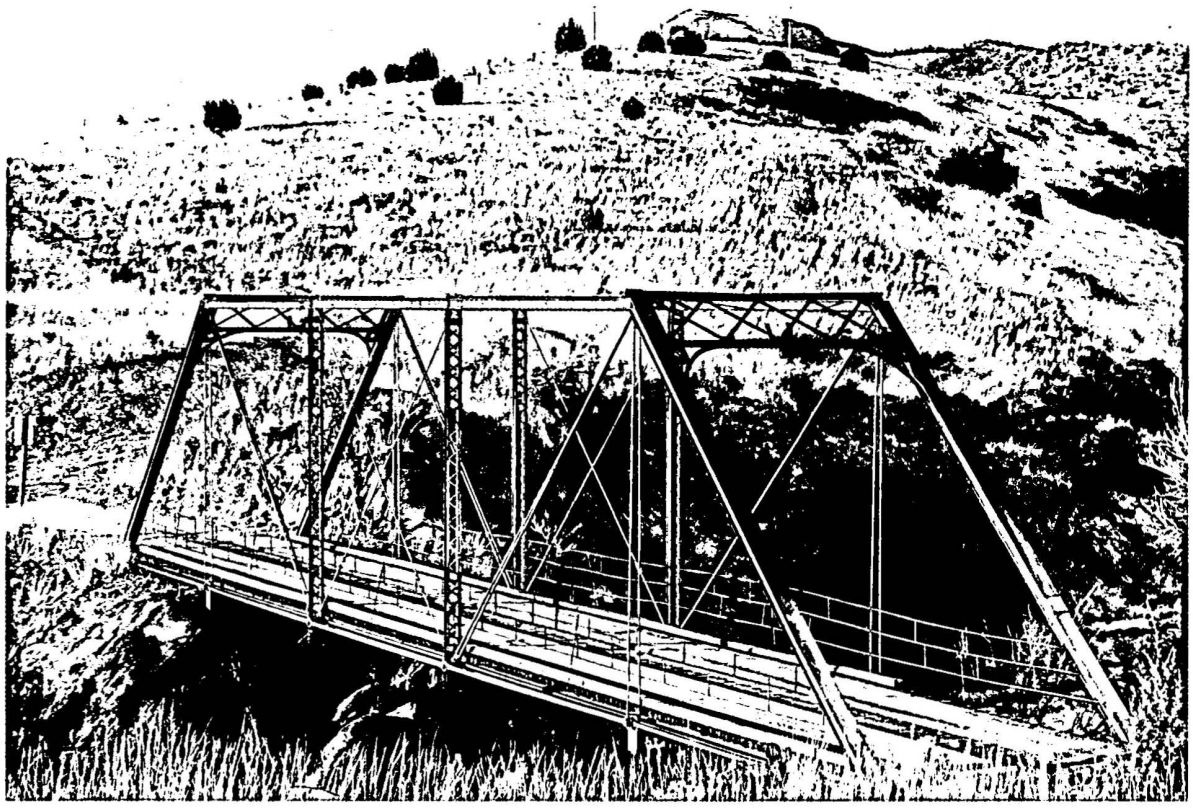


Fig. 31. **Cold Spring Canyon Bridge** (No. 1894)

The present bridge across the Gallinas River is a steel through truss and has a total length of 105 feet. It is a Pratt truss with pinned connections and heavy members due to its railroad design. It is supported at each end by masonry abutments built of large cut stones typical of railroad construction. This bridge adjoins the Montezuma Historic District and is unique since it was formerly used as a railroad structure. The Gallinas Bridge has been by-passed by a new bridge and preserved in place by the New Mexico State Highway and Transportation Department.

Animas River Bridge*

No. 8120
County Road A-136 at Cedar Hill
San Juan County

The site of Cedar Hill was first settled by A. U. Graves in 1877 when he and his father-in-law, H. W. Cox, established a ranch at this location on the Animas River. Graves operated a horse-drawn ferry and later constructed a toll bridge across the river. Grave's toll bridge is believed to have been a timber truss structure. It was reportedly the only bridge over the Animas between Durango, Colorado, and Aztec, New Mexico, in 1900.

The existing Animas River Bridge at Cedar Hill is a steel through truss with pinned connections located near the site of Grave's original crossing. This bridge is 100 feet in length and has a 14-foot roadway. It has a Pratt truss design with built-up steel lattice beams for its vertical members and steel bars for its diagonal members. Some records indicate that the bridge was constructed in 1912 but this date has not been confirmed.

This bridge is presently in use on an unpaved county road. The site adjoins irrigated farmland to the north and a rock bluff to the south. The setting complements the age of the

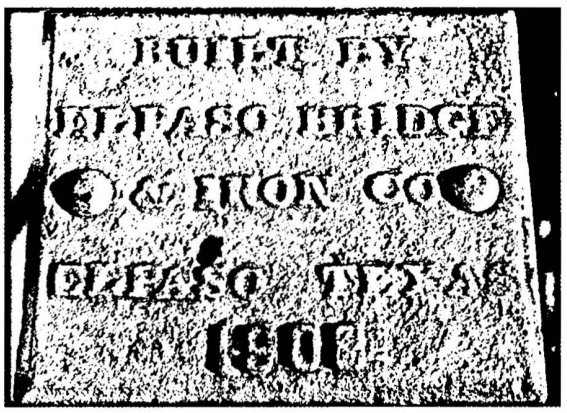
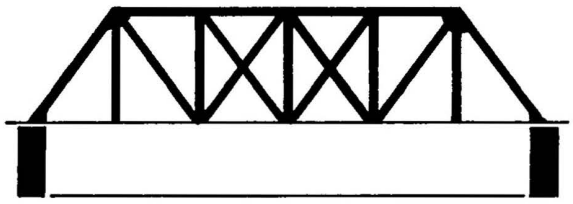


Fig. 32. **Cold Spring Canyon Bridge Nameplate** (No. 1894)

bridge and its association with the past. The Animas River Bridge is a good example of a light-weight steel through truss with pinned connections and it is one of the earliest steel truss bridges remaining in the state.

Animas River Bridge
No. 8121
County Road A-141
near Cedar Hill
San Juan County

This bridge is located over the Animas River about one and a half miles north of Cedar Hill. It is a Pratt through truss with pinned connections and has a span of 120 feet. Two 20-foot timber approach spans are located on the east end of the truss. Additional support is provided by three piers constructed of steel pipe located under the truss span. This bridge was probably constructed during the early 1900s and moved to its present site in recent years.



Pratt Through Truss, Rigid Connections

As vehicle weights and loads on bridges increased, truss designs were modified to carry greater loads and more traffic. Light-weight members with pinned connections gave way to heavier members with rigid connections adding more stability and greater load carrying capacity to bridges.

The Pratt truss bridge with heavier members and rigid connections was very popular with the New Mexico State Highway Department during the 1920s and early 1930s. A standard design length of 101 feet was used by the Highway Department at many locations throughout the state. Components for these bridges were usually provided by bridge fabrication companies and were assembled by bridge construction firms. Even with rigid connections, the Pratt truss was comparatively easy to erect. A number of these bridges were dismantled and moved to new locations when conditions required an improved crossing.

There are now six Pratt through truss bridges of the 101-foot design remaining in New Mexico. Three of these bridges remain at their original sites and the other three have been relocated to new sites. An additional Pratt through truss bridge with rigid connections and a special skewed design is located over the Rio Felix near Hagerman, New Mexico.

Rio Felix Bridge*
No. 357
NM 2 near Hagerman
Chavez County

During 1925 to 1926, the State Highway Department undertook at least a dozen large-scale bridge construction projects. One of the most impressive of these projects was construction of the Rio Felix Bridge between Roswell and Carlsbad. The Rio Felix Bridge in-

Fig. 33. Rio Felix Bridge (No. 357)

cludes three Pratt truss spans, each 144 feet in length. Concrete piers and abutments were used to support the spans. A concrete deck was poured in place and earth-fill material was installed at each end for the approaches. In order to publicize its completion in 1926, the Rio Felix Bridge was featured on the cover of the November issue of the *New Mexico Highway Journal.*

The most interesting engineering feature of the bridge is the skew of the steel truss spans. The bridge itself is located on a section line road running north and south, and it crosses the Rio Felix at an angle of about 45 degrees. The piers of the bridge were placed parallel to the streambed to provide increased stability during floods. The position of the piers required the truss spans to be offset one panel length in order for the spans to sit properly on the piers. The Rio Felix Bridge is the only truss bridge in New Mexico with skewed truss members.

The Rio Felix Bridge was completed in August, 1926, under the supervision of William S. Henderson, project engineer for the State Highway Department. James A. French, New Mexico's first State Engineer, had overall responsibility for the project. The contractor for erecting the bridge was the Boardman Company of Oklahoma City.

The Rio Felix Bridge was a major highway structure on the road between Roswell and Carlsbad which provided an important transportation link in the development of the Pecos River Valley and southeastern New Mexico. In 1984, the Rio Felix Bridge was by-passed by a new bridge and was preserved in place by the New Mexico State Highway and Transportation Department. It is the longest Pratt truss bridge with rigid connections remaining in New Mexico and it has been listed on the State Register of Cultural Properties. (Figure 33)

John Dunn Bridge*

No. 5243
County Road B-7
near Arroyo Hondo
Taos County

John Dunn was a legendary character of the Taos area who operated a toll bridge across the Rio Grande near its confluence with the Arroyo Hondo during the early 1900s. Dunn was accused of a number of crimes in his younger days but lived long enough to become a respectable businessman of Taos. John Dunn's original bridge was a timber span supported by log crib piers. In 1951, this bridge was replaced by a steel truss bridge which is still referred to as the John Dunn Bridge.

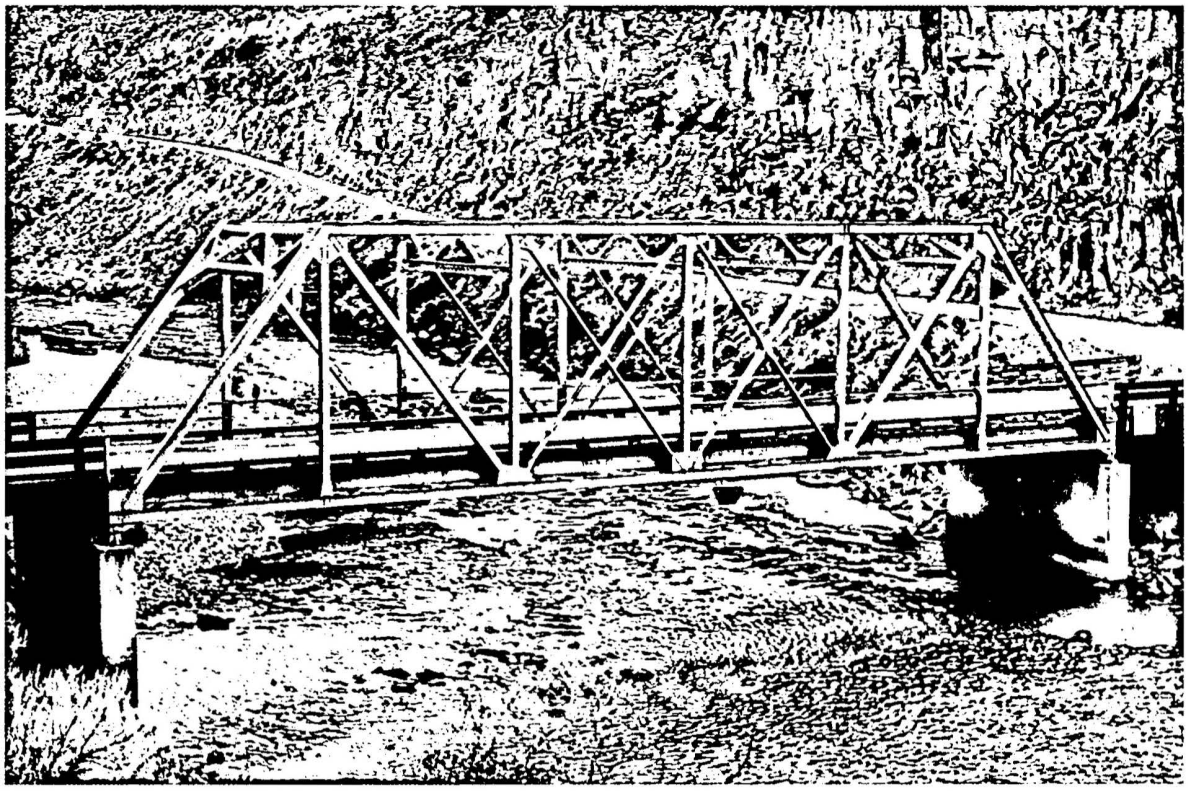


Fig. 34. **John Dunn Bridge** (No. 5243)

The existing steel truss bridge was moved from west of Gallup by J. H. Ryan and Son. This bridge is a Pratt truss and has a length of 101 feet. A 30-foot timber approach span was added to each end of the truss providing a total bridge length of 161 feet. The site of the John Dunn Bridge is located in the Rio Grande Canyon on a county road. This bridge is a good example of the steel through truss bridges which were popular during the 1920s and early 1930s. (Figure 34)

Rio Grande Bridge*
No. 5826
NM 96 at Rio Grande Gorge State Park
Taos County

A timber pony truss bridge was located across the Rio Grande at this site prior to construction of the existing steel through truss in 1957. The old bridge was a Howe truss with timber diagonals and iron rods for vertical members. It was supported by log crib piers filled with rocks. This bridge was required for crossing the Rio Grande on the old wagon road between Taos and the railhead at Taos Junction.

The present steel truss span was fabricated in 1930 by the Virginia Bridge and Iron Company and was first erected over the Canadian River on US 85 south of Raton. It was moved to its present site over the Rio Grande in 1957 by J. H. Ryan and Son. This steel truss has a Pratt design and a length of 101 feet. A 26-foot concrete approach span has been added to each end of the truss providing a total length of 153 feet. This structure is an example of an early steel truss bridge which was relocated to a new site.

Mimbres River Bridge*
No. 1332
NM 90 at San Lorenzo
Grant County

"Ever since the gold strike in Hillsboro in 1877, prospectors and settlers in the mining region of the Black Range in Sierra and Grant Counties have dreamed of the day when Silver City and Hillsboro would be linked with a real highway across those mountains." *(New Mexico Highway Journal,* February, 1929, p. 10).

In 1927, a steel through truss was constructed across the Mimbres River at San Lorenzo completing an important link in this route known as the Black Range Road.

The Mimbres River Bridge is a Pratt truss with rigid connections and has a length of 101 feet. It was fabricated by the Virginia Bridge and Iron Company of Roanoke, Virginia. The contractor for erecting the bridge was the Ware Company of El Paso.

This bridge is representative of the many standard length Pratt through trusses constructed in New Mexico during the 1920s and early 1930s. It remains in use on NM 90 between Silver City and Hillsboro.

Percha Creek Bridge
No. 1520
NM 90 near Hillsboro
Sierra County

This bridge is located about five miles west of Hillsboro on NM 90 and was completed in 1929 as part of the Black Range Road. It is a steel through truss with timber stringers and deck. It has a total length of 101 feet and a 19-foot roadway. A Pratt design was used in its construction which includes six panels at 16.5 feet each.

This bridge was fabricated by the Virginia Bridge and Iron Company and erected by Dudley and Amesbury. It is situated across a small rock canyon and is a good example of truss bridge construction of the 1920s and early 1930s in New Mexico.

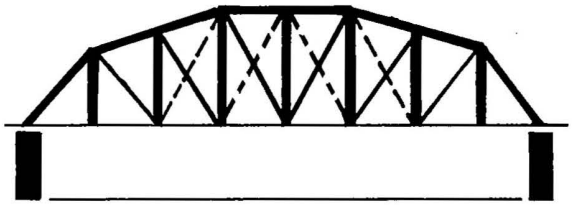
Percha Creek Bridge
No. 1521
NM 90 near Hillsboro
Sierra County

This bridge is located about seven miles west of Hillsboro and was also completed in 1929 as a part of the Black Range Road. It is a steel through truss and has a total length of 101 feet. A Pratt design was used in its construction which is identical to that of Bridge No. 1520 located two miles east. This bridge was also fabricated by the Virginia Bridge and Iron Company and erected by Dudley and Amesbury.

Rio Pueblo Bridge
No. 5228
Private Road near Vadito
Taos County

This bridge was originally constructed in 1926 over the Rio Puerco of the West near Gallup, New Mexico. It was later moved to Eagle Creek in Eddy County and then to its present

site over the Rio Pueblo about 1966. It is a steel through truss and has a total length of 101 feet. A Pratt design was used in its fabrication. This bridge now is privately owned and used to provide access off NM 3 to several homes.



Parker Through Truss

The Parker through truss was a popular variation of the Pratt truss which has a characteristic polygonal top chord as compared to the horizontal top chord of the Pratt. The polygonal top chord of the Parker allows for better stress and bending distribution throughout the structure. The Parker truss design also allows for construction of longer spans. Parker spans in New Mexico ranged from about 100 to 250 feet, while Pratt truss spans ranged from 100 to 150 feet.

The Camelback truss is a type of Parker truss which is identified by its polygonal top chord having exactly five slopes. The top chord at the center of the truss is horizontal. An intermediate and an end post slope are located on each side of the center providing a total of five slopes. In many areas of the United States, the Camelback was preferred because of its standardized design and construction.

The Parker through truss was used by the New Mexico State Highway Department for major bridge structures during the 1920s and 1930s. At this time, there are 11 Parker through truss bridges known to exist in various conditions in the state. Six of the remaining 11 Parker truss bridges are still in use and are maintained by the State Highway and Transportation Department. One of the longest bridges ever constructed in New Mexico is the San Juan River Bridge at Shiprock which is composed of six Parker through truss spans.

San Juan River Bridge*

No. 1792
US 666 at Shiprock
San Juan County

Completion of the San Juan River Bridge at Shiprock in 1937 represents the high point of steel through truss bridge construction in New Mexico. This bridge is composed of six 167-foot Parker through truss spans and has a total length of 1007 feet. It was designed by the New Mexico State Highway Department and built as a federal aid project under the administration of Governor Clyde Tingley. W. E. Bondurant was the contractor for the project.

The San Juan River Bridge was remodeled in 1958 and a new parallel bridge has been constructed. The original bridge now carries two traffic lanes south from Shiprock.

The San Juan River Bridge is an important transportation link between Shiprock and the Navajo lands located to the south. It is the longest steel truss bridge remaining in New Mexico and it has been included on the State Register of Cultural Properties. (Figure 27)

Fig. 35. **San Francisco River Bridge** (No. 599)

San Francisco River Bridge*
No. 599
US 180 near Alma
Catron County

The San Francisco River Bridge was constructed in 1926 as a Forest Service project to provide access to public lands in southwestern New Mexico. This bridge includes two steel through truss spans and two concrete approach spans. The length of each truss span is 112 feet and the total length of the bridge is 264 feet. The bridge was designed by the Bureau of Public Roads and was erected by the Salle Construction Company of Pueblo, Colorado.

The construction of this bridge was a very large undertaking for the Forest Service due to its remote location and size of the project. The San Francisco River Bridge has recently been by-passed by a new bridge and preserved in place by the New Mexico State Highway and Transportation Department. It is one of the oldest known Parker truss bridges remaining in the state. (Figure 35)

Rio Puerco Bridge*
No. 531
NM 116 near Bernardo
Socorro County

The Rio Puerco, named for its muddy appearance, has long been known for its uncontrolled floods. In August, 1929, a huge flood destroyed part of the newly completed timber trestle bridge across the Rio Puerco at Bernardo. The bridge was repaired by the addition of two through truss spans of 142 feet each and a 50- foot steel I-beam span. These new spans along with the remaining timber spans provided a total bridge length of 542 feet.

Each through truss has a Parker design with nine panels of 15.5 feet. The truss spans were fabricated by the Virginia Bridge and Iron Company and erected in 1930 by Armstrong and Armstrong Construction Company. The Rio Puerco Bridge has been by-passed and now carries only light traffic. This bridge is a good example of truss construction combined with other spans to provide a major bridge structure for the 1930s. (Figure 16)

Animas River Bridge*
No. 119
NM 550 at Aztec
San Juan County

The Animas River Bridge at Aztec replaced an earlier cable and timber suspension bridge built for San Juan County across the Animas River in 1908 by J. S. Thurston and Sons of Aztec. (Figure 21)

The new bridge was constructed as a Federal-Aid Project in 1929 by the Pueblo Bridge and Construction Company. It includes a 200-foot through truss span and two 75-foot pony truss approach spans. A Parker truss design with its characteristic polygonal top chord was used for the main span while a Warren truss design was used for the approach spans.

This bridge was the principal highway crossing at Aztec and was a major highway structure in the state upon its completion. It now serves as a one-lane bridge on the busi-

Fig. 36. **Animas River Bridge at Aztec** (No. 119)

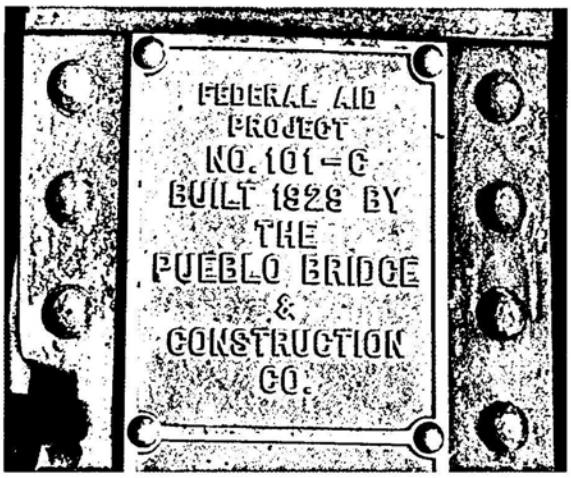


Fig. 37. **Animas River Bridge Nameplate** (No. 119)

ness route through Aztec. The Animas River Bridge is noteworthy in that it includes both a through truss and two pony trusses in its design. (Figures 36 & 37)

Animas River Bridge

No. 3681
NM 550 at Cedar Hill
San Juan County

This bridge is similar to the Animas River Bridge at Aztec. It includes a 200-foot Parker through truss span and two 75-foot Warren pony truss approach spans. J. H. Miller and Company was the contractor for the project.

The Animas River Bridge on NM 550 at Cedar Hill was completed in 1933. It was abandoned in 1964 when the highway was rerouted to the west and it no longer carries any traffic. A number of the steel members have been removed from the bridge and used for other purposes.

Rio Hondo Bridge*

No. 5272
NM 395 near Tinnie
Lincoln County

The Rio Hondo Bridge at Tinnie is a steel through truss with a polygonal top chord, distinctive of the Parker design. It is 142 feet in length and has a 19-foot roadway.

Highway Department records indicate that this bridge was originally constructed in 1927 at Bull Canyon in Quay County. In 1952, it was moved and erected at its present site by J. H. Ryan and Son. The Rio Hondo Bridge at Tinnie is a good example of the Parker steel truss which was preferred for moderate to long spans by the Highway Department. This bridge is in use on NM 395 and has been listed on the State Register of Cultural Properties. (Figure 38)

Rio Puerco Bridge

No. 2530
I-40 Frontage Road
near Albuquerque
Bernalillo County

Although the flow of the Rio Puerco west

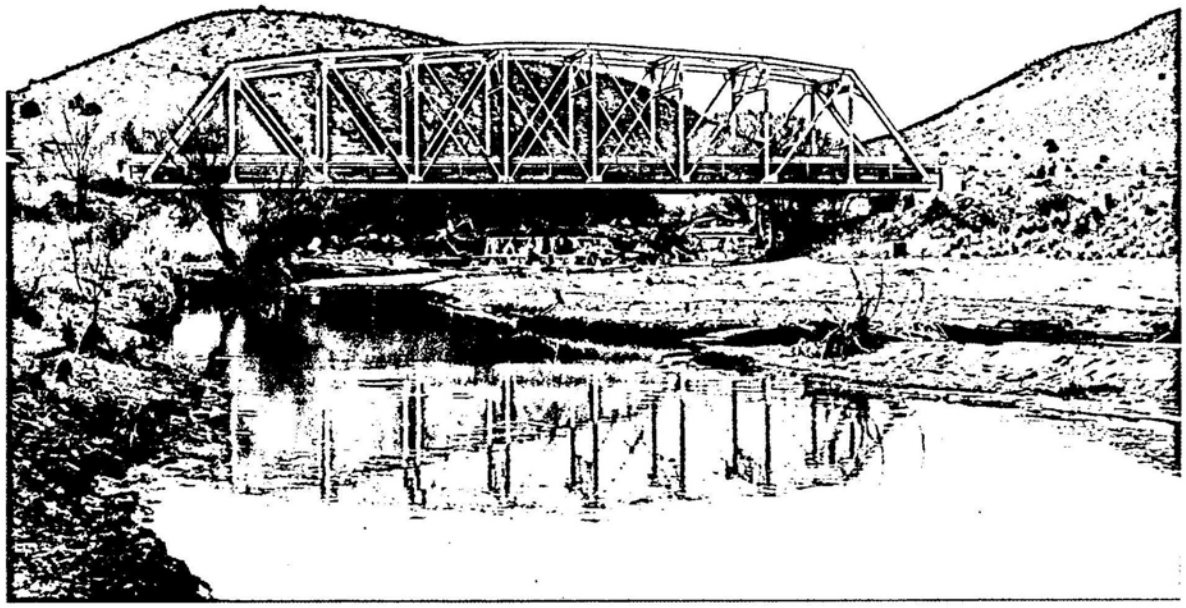


Fig. 38. **Rio Hondo Bridge near Tinnie** (No. 5272)

of Albuquerque is often negligible, the Puerco is known for its violent floods and embankment erosion. In view of this potential for failure, the State Highway Department selected a 250-foot Parker through truss for bridging the Rio Puerco at this location to eliminate the need for a center pier and to prevent washouts.

The 250-foot span over the Rio Puerco is one of the longest steel truss spans constructed in New Mexico. The bridge was fabricated by the Kansas City Structural Steel Company and was erected by F. D. Shufflebarger of Albuquerque in 1933. The Rio Puerco Bridge was a major highway structure on US 66 during the 1930s and 1940s. Repairs and remodeling of the bridge were completed in 1957. At the present time, it serves as a frontage road structure for I-40.

Raton Overpass
No. 1824
US 85 at Raton
Colfax County

This bridge represents one of the last major highway structures completed in New Mexico prior to World War II. The Raton Overpass on US 85 is composed of a steel through truss and two steel beam approach spans. The lengths of these spans are 71, 167 and 71 feet, respectively. The steel truss span is a Parker design and it is supported by massive concrete piers approximately 50 feet in height. The roadway width of the overpass is 26 feet.

The Raton Overpass was completed in 1940 by the Skousen Brothers. In addition to crossing over the two main tracks of the Santa Fe Railway, the overpass also crosses Raton Creek eliminating the need for a separate structure. This overpass was one of the last through truss spans constructed in the state.

Pecos River Bridge*
No. 1001
Private Road near San Jose
San Miguel County

This bridge was located on the main road from Las Vegas to Santa Fe near the route of the Santa Fe Trail. Highway Department records indicate that it was fabricated by the Missouri Valley Bridge and Iron Company and erected in 1921.

The Pecos River Bridge at San Jose is a steel through truss with a Parker design. This span has a 16-foot roadway and a length of 106 feet which is relatively short for a Parker truss. Two timber approach spans located on the east end of the bridge have collapsed due to a fire. The bridge has been abandoned and the site returned to a private land owner.

Glade Arroyo Bridge
No. 113
Private Road near Farmington
San Juan County

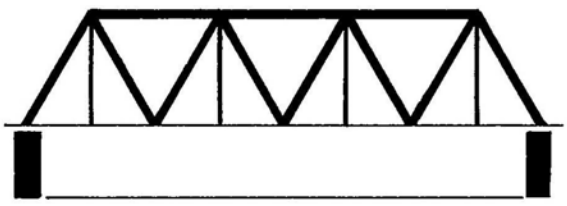
The Glade Arroyo Bridge is a single-span Parker through truss and has a length of 142 feet. This bridge was located over Glade Arroyo, northwest of Farmington. Upon completion of a new bridge over Glade Arroyo, it was moved intact several miles to an open field near the La Plata River where it is to be installed for a private crossing.

This bridge was erected in 1927 by C. A. Switzer of Basalt, Colorado. J. H. Ryan served as project engineer for the Highway Department during its construction. It is an example of a number of 142- foot Parker truss bridges built in New Mexico during the late 1920s and early 1930s.

Bolack Ranch Bridge
No. S-13
Private Road near Farmington
San Juan County

This bridge was originally a railroad structure located over the Animas River at Flora Vista, New Mexico. In 1981, it was moved intact by ex-Governor Tom Bolack to his ranch east of Farmington and placed across the San Juan River.

The Bolack Ranch Bridge is a Parker truss with pinned connections. It is 167 feet in length and has heavy steel members due to its railroad design. This bridge is a well preserved example of a steel railroad truss now used for vehicular traffic on a private road.



Warren Through Truss

The Warren truss was developed during the 1840s, about the same time as the Pratt truss. The Warren design is characterized by

its triangular shaped panels composed of diagonals acting alternatively in either tension or compression. Vertical members were often added from the top point of the triangular panels to the bottom chord to provide stiffening for the truss. Rigid metal beams were normally used for both the diagonal and vertical members. The Warren truss was widely used for bridge construction in the United States during the late 1800s and early 1900s and it continues to be popular for deck truss construction and other applications.

Construction of Warren through truss bridges was limited in New Mexico. The State Highway Department preferred Pratt and Parker truss designs for through truss bridges and they utilized the Warren design primarily for pony and deck truss spans. At the present time, only three Warren through truss bridges remain in New Mexico. The most impressive of these structures is the three span Warren through truss bridge over the Gila River near Cliff, New Mexico.

Gila River Bridge*

No. 1382
County Road 50 near Cliff
Grant County

The State Highway Commission was organized in 1912 and included Governor William C. McDonald, Land Commissioner Robert P. Ervien, and State Engineer James A. French. One of the earliest bridge projects funded by the Commission was the construction of the Gila River Bridge completed in 1915. This bridge was constructed on the state road between the mining districts of Silver City and Mogollon in southwestern New Mexico. It was an important link in the early state highway system connecting the mountainous Gila region with Silver City and the southern part of the state.

The Gila River is known for its torrential floods which made a major bridge structure necessary at this site. The bridge is a steel through truss structure with three main spans of 112 feet each and two timber approach spans of 20 feet each. The total length of the bridge is 376 feet.

The Gila River Bridge was fabricated by the El Paso Bridge and Iron Company. The original nameplate showing the date of construction and bridge fabricator is still located on the east portal of the bridge. The bridge has been by-passed and it is now in use as a single lane bridge on a county road. The Gila River Bridge is the oldest Warren through truss remaining in New Mexico. (Figures 39 & 40)

Largo Canyon Bridge*

No. 8118
County Road A-80 near Blanco
San Juan County

This bridge was originally constructed in 1928 over the San Juan River at Blanco by the Pueblo Bridge and Construction Company. In 1966, it was relocated about five miles east over Largo Arroyo on a county road.

The Largo Canyon Bridge is a steel through truss and has a total length of 254 feet. Its road-

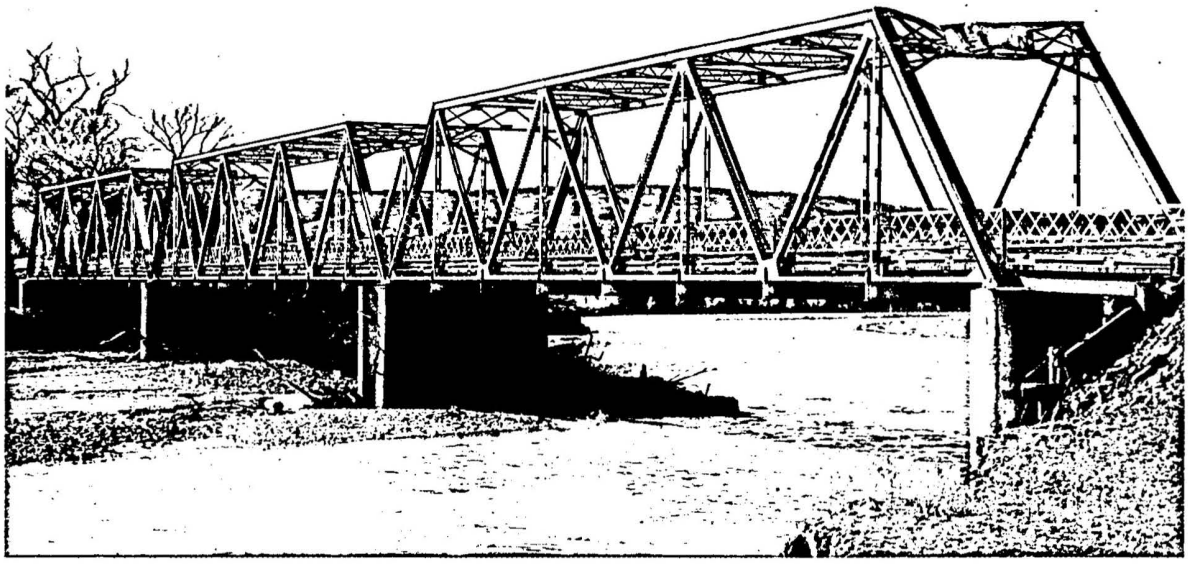


Fig. 39. **Gila River Bridge** (No. 1382)

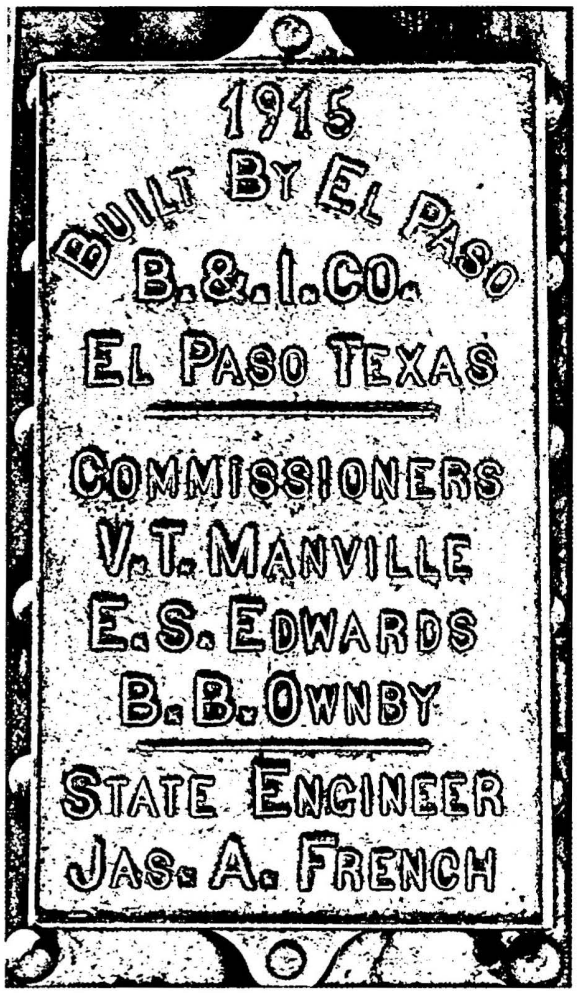
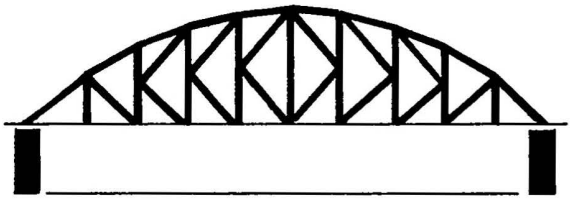


Fig. 40. **Gila River Bridge Nameplate** (No. 1382)

way is only 13 feet wide. A Warren truss consisting of seven triangular panels was used in its design. The Largo Canyon Bridge is one of the longest truss spans constructed in New Mexico.

Animas River Bridge
No. 401
Miller Street at Farmington
San Juan County

This bridge was erected in 1928 over the Animas River by the Pueblo Bridge and Construction Company. It includes a 200-foot Warren through truss and two 20- foot timber approach spans. In 1952, the bridge was damaged by a truck loaded with a bulldozer which hit and broke some of the overhead truss members. Steel beams were cut and spliced in order to repair the bridge. At the present time, the Animas River Bridge is used as a one-way crossing with traffic being controlled at each end by a stop light.



K Through Truss

The K truss was developed in the early 20th century and obtains its name from the K shaped outline of its members. It is a special type of subdivided truss where sub-diagonal and sub-vertical members have been added and other members rearranged to provide additional floor support and reduced bending moment. The K truss and other subdivided trusses such as the Baltimore and Pennsylvania trusses were designed for longer spans and represented an advancement over the standard Pratt and Warren truss designs.

Construction of bridges using the K truss design was limited. Only one K through truss bridge is known to have been built in New Mexico. It is the Otowi Truss Bridge over the Rio Grande between Santa Fe and Los Alamos.

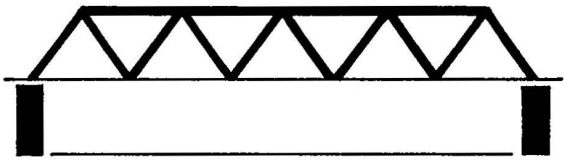
Otowi Truss Bridge
No. 3469
NM 4 at Otowi
Santa Fe County

This bridge was constructed in 1948 and replaced the suspension bridge over the Rio Grande at Otowi. It was constructed at the end of the truss building period in New Mexico and was the last new through truss to be erected in the state. The K truss design was used for this bridge due to its relatively long span to reduce the bending moment and secondary stresses in its members.

The Otowi Truss Bridge has a total length of 292 feet and a 24-foot roadway. It was fabricated by the Virginia Bridge Company and erected by Miller and Smith of Albuquerque. This bridge is the longest remaining truss span in the state and it is scheduled to be replaced by a new bridge at this site.

The Otowi Truss Bridge represents a unique truss design and one of the last built examples of the truss technology in New Mexico that was abandoned in favor of the use of modern steel beam and pre-stressed concrete construction. The site of this bridge is a historic crossing on the Rio Grande which has been in-

cluded on the National Register of Historic Places. (Figure 41)



Warren Pony Truss

A pony truss bridge is a small through truss bridge without lateral bracing between the top chords. They were normally used for spans from 50 to 100 feet. Many pony truss bridges were built in New Mexico during the early 1900s as county projects. The most popular design used for construction of these earliest pony truss bridges was the Warren, characterized by its triangular shaped panels. During the 1930s, the State Highway Department began to show a preference for pony truss bridges constructed with a Parker design and a standard length of 100 feet.

At the present time, there are eight Warren pony truss bridges known to remain in New Mexico. In addition, Warren pony truss spans remain as approach spans for the Animas River Bridge at Aztec (No. 119) and for the Animas River Bridge at Cedar Hill (No. 3681). Descriptions of these bridges are listed under the Parker Through Truss heading of this section.

Mora River Bridge*

No. 4984
NM 97 near Shoemaker
Mora County

This bridge was originally located over the Sapello River at Watrous, New Mexico. In 1934, a new bridge was constructed at this site and the old spans were moved east about eight miles to their present location.

The Mora River Bridge at Shoemaker is a steel pony truss with three spans of 76 feet each. The total length of the bridge is 230 feet. The truss members of the bridge are constructed of built-up lattice beams and are arranged in triangular shapes, characteristic of the Warren truss design. The roadway is 15 feet wide and the original steel guardrails are attached to the truss on each side. Masonry piers constructed with rough cut stones are used to support the truss spans.

According to Highway Department records, the bridge was fabricated by the Missouri Valley Bridge and Iron Company of Leavenworth, Kansas. It is presently used as a one lane bridge on NM 97. (Figure 42)

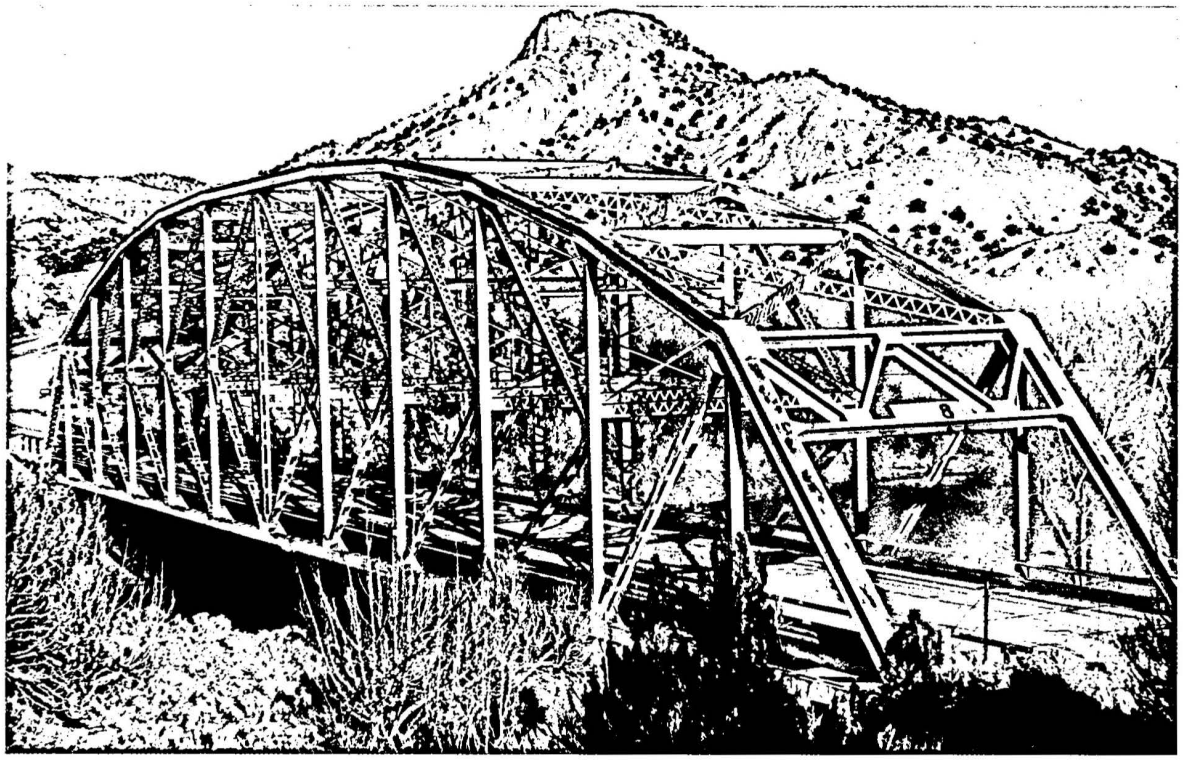


Fig. 41. **Otowi Truss Bridge** (No. 3469)

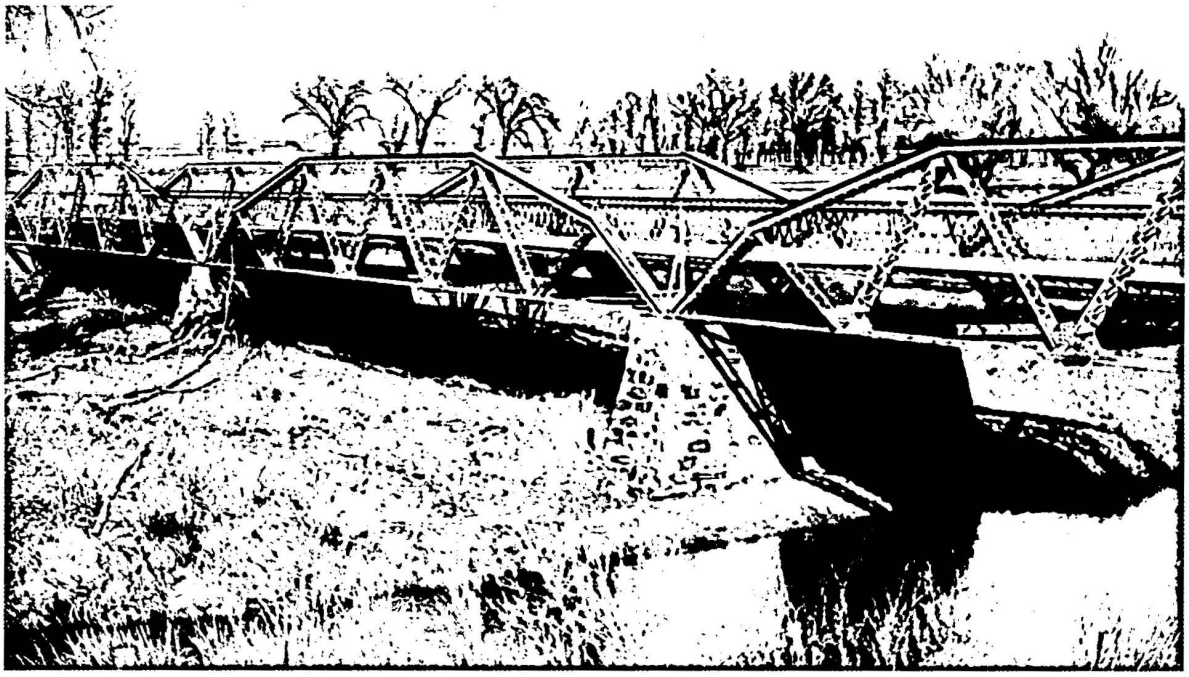


Fig. 42. **Mora River Bridge** (No. 4984)

Kearny's Gap Bridge*
No. 5507
NM 283 near Las Vegas
San Miguel County

This bridge was named for the opening in the range of hills southwest of Las Vegas which was used by General Stephen W. Kearny and his Army of the West in August, 1846, on their march to Santa Fe.

Kearny's Gap Bridge was constructed as a county project under the supervision of George E. Morrison, civil engineer of East Las Vegas, who prepared the plans for the project. Bids were received by the County Commissioners on September 20, 1913, and the Missouri Valley Bridge and Iron Company was awarded the project. Final plans, specifications and contracts were approved by State Engineer James A. French on September 24, 1913, and the project was completed in February of 1914.

This bridge is a steel pony truss structure and has a total length of 62 feet. A Warren truss design was used in its construction. The bridge has been abandoned in place and the site has been returned to a private owner.

Starkweather Canyon Bridge*
No. 2208
NM 12 near Reserve
Catron County

The Starkweather Canyon Bridge was constructed in 1939 as a Forest Service project about two miles east of Reserve, New Mexico. This bridge is a single span pony truss structure and has a length of 100 feet. The bridge is located on a slight curve in the road and the deck section is sloped to compensate against skidding.

Pony truss bridges were widely used in New Mexico for spans ranging up to 100 feet. The Starkweather Canyon Bridge is a good example of a Warren pony truss bridge with the added design feature of a superelevated deck.

Ute Creek Bridge
No. 8041
County Road D near Logan
Harding County

This bridge includes three of the five 90-foot steel pony truss spans which were fabricated in 1916 by the El Paso Bridge and Iron Company and were originally located over the Rio Grande at Las Cruces. A Warren design was used in their construction. Four of the five spans were disassembled and moved to Revuelto Creek on NM 39, southeast of Logan, sometime during the 1930s. On December 17, 1956, one of the spans was severly damaged by a truck and, in 1957, the remaining three spans were moved to Ute Creek, northwest of Logan.

Due to the raising of the spillway and enlargement of Ute Lake in 1984, the Ute Creek Bridge was removed and the three original spans were obtained by Harding County. The spans have been stockpiled at locations south of Gallegos, New Mexico, for installation over two arroyos.

The history of these spans exemplifies the versatility of truss bridges and the practice used by the Highway Department of moving them from place to place as conditions change.

Gallegos Bridge
No. 8040
County Road D at Gallegos
Harding County

This bridge is a 75-foot steel pony truss located over a small arroyo at Gallegos. It was originally designed as a Warren truss with six 15-foot panels, but one panel has been removed. This bridge is believed to be the damaged pony truss span moved from Revuelto Creek. The Revuelto Creek Bridge was fabricated in 1916 and was originally located over the Rio Grande at Las Cruces.

Carrizo Wash Bridge
No. 8153
County Road 191 near Salt Lake
Catron County

This bridge is located on a lightly traveled dirt road about three miles east of the Arizona border. The bridge is a steel pony truss span with a 68 foot length and a 16-foot roadway. Masonry abutments of local stone are used to support the bridge which includes a timber deck and guardrails.

The date of construction and the bridge builder are not known, but the Highway Department records indicate that the bridge was probably relocated from another site in 1940. This bridge is representative of the many Warren pony truss bridges which were used on county roads and secondary roads in remote areas of the state.

Chicorico Creek Bridge
No. 7743
County Road A-11 near Raton
Colfax County

This bridge has a 51-foot length and 15-foot roadway. It has a Warren truss design and it is supported by concrete abutments. The Chicorico Creek Bridge includes a timber deck and its original steel lattice guardrail. The bridge fabricator and contractor are not known but the bridge was probably constructed during the 1920s. (Figure 43)

Bonito Creek Bridge
No. 8019
Private Road near Hondo
Lincoln County

This bridge was completed in 1920 and is an early example of the Warren pony truss bridges which were once common throughout the state. It includes four panels of 15 feet each and has a total length of 60 feet. The design drawings for this bridge were signed by James A. French, New Mexico's first State Engineer.

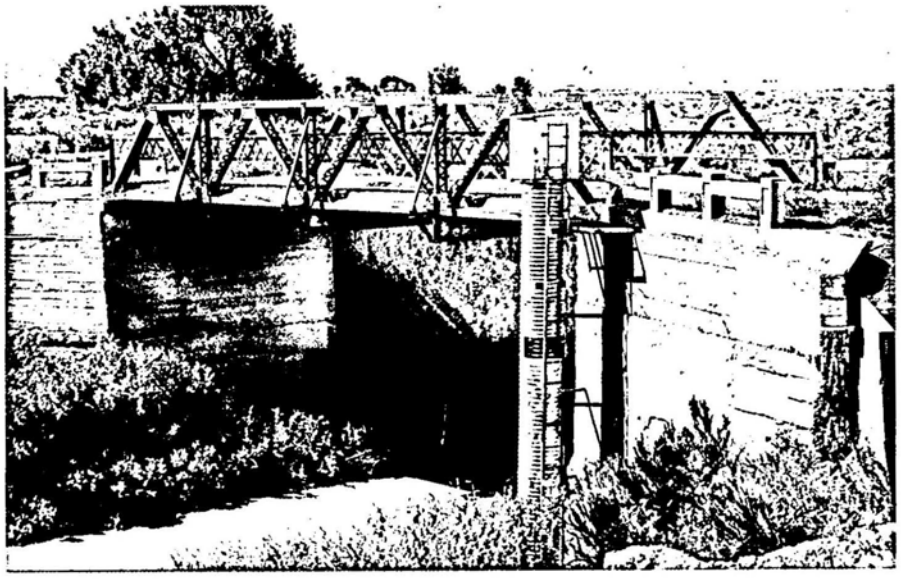
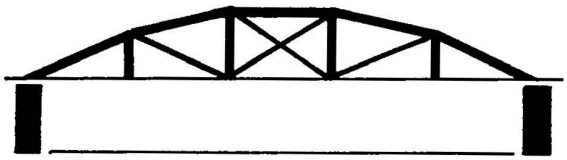


Fig. 43. **Chicorico Creek Bridge** (No. 7743)



Parker Pony Truss

The Parker truss is a variation of the Pratt truss design and is characterized by its polygonal top chord as compared to the horizontal top chord of the Pratt. During the 1930s, pony truss bridges of this type, with a standard length of 100 feet, were erected at a number of locations by bridge construction companies under contract to the Highway Department.

Five Parker pony truss bridges are known to remain in New Mexico. Among these is the Rio Grande Bridge at San Juan Pueblo which was a major bridge structure upon its completion.

Rio Grande Bridge*

No. 1578
NM 74 at San Juan Pueblo
Rio Arriba County

In January, 1925, C. J. Crandall, Superintendent of the Northern Pueblos, reported in the *New Mexico Highway Journal* that a bridge would be constructed across the Rio Grande at San Juan Pueblo by the Office of Indian Affairs. The new bridge was needed for access to farming lands located west of the Pueblo during periods when the river could not be forded. Plans were prepared by the Monarch Engineering Company of Denver and the bridge was completed later in 1925.

This bridge is a steel pony truss structure using a Parker design. It includes four spans of 100 feet each and has a 17.5 foot roadway. The bridge connects San Juan Pueblo on its east bank with the site of San Gabriel, the first capitol of New Mexico established by Oñate in 1598. San Gabriel has been designated a National Historic Landmark. The Rio Grande Bridge at San Juan Pueblo is presently in use as a one-lane crossing and it is the longest pony truss bridge remaining in the state. (Figure 44)

Gallinas River Bridge*

No. 900
County Road A-11 at Montezuma
San Miguel County

The Montezuma Hotel, once operated in connection with the Santa Fe Railway, was known for its luxurious accommodations and for its hot springs and mud baths. The existing hotel building, often referred to as Montezuma Castle, was constructed in 1886 and is now in use as a college headquarters.

Plans for the steel pony truss bridge at Montezuma are dated March, 1911, and the

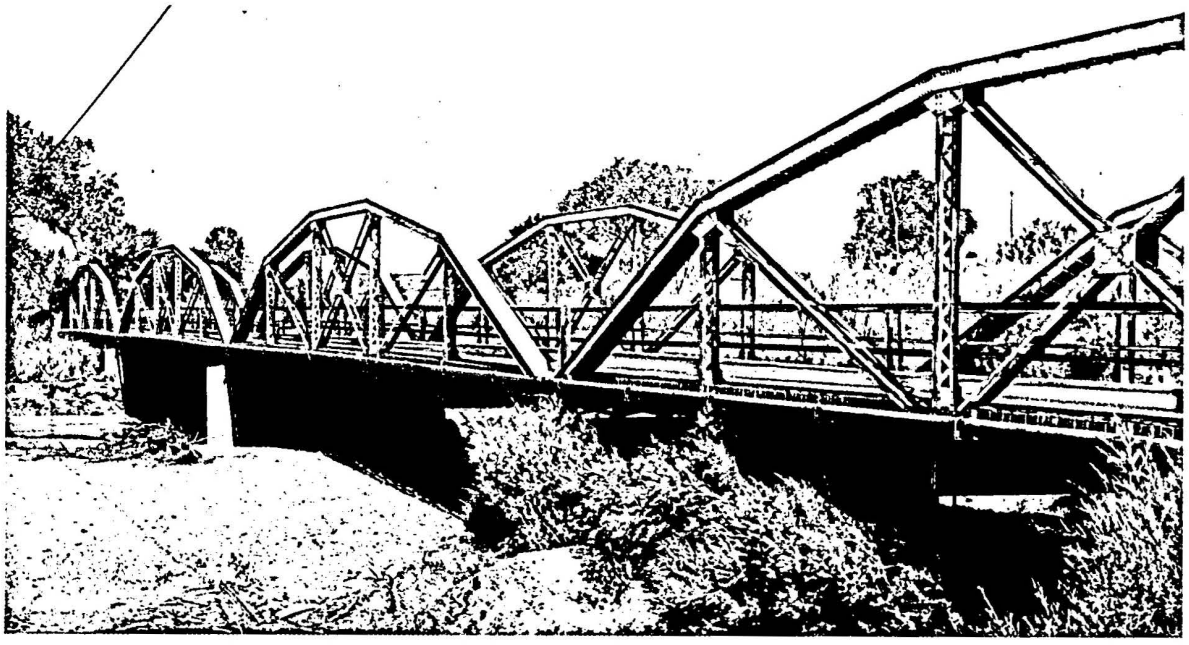


Fig. 44. **Rio Grande Bridge at San Juan Pueblo** (No. 1578)

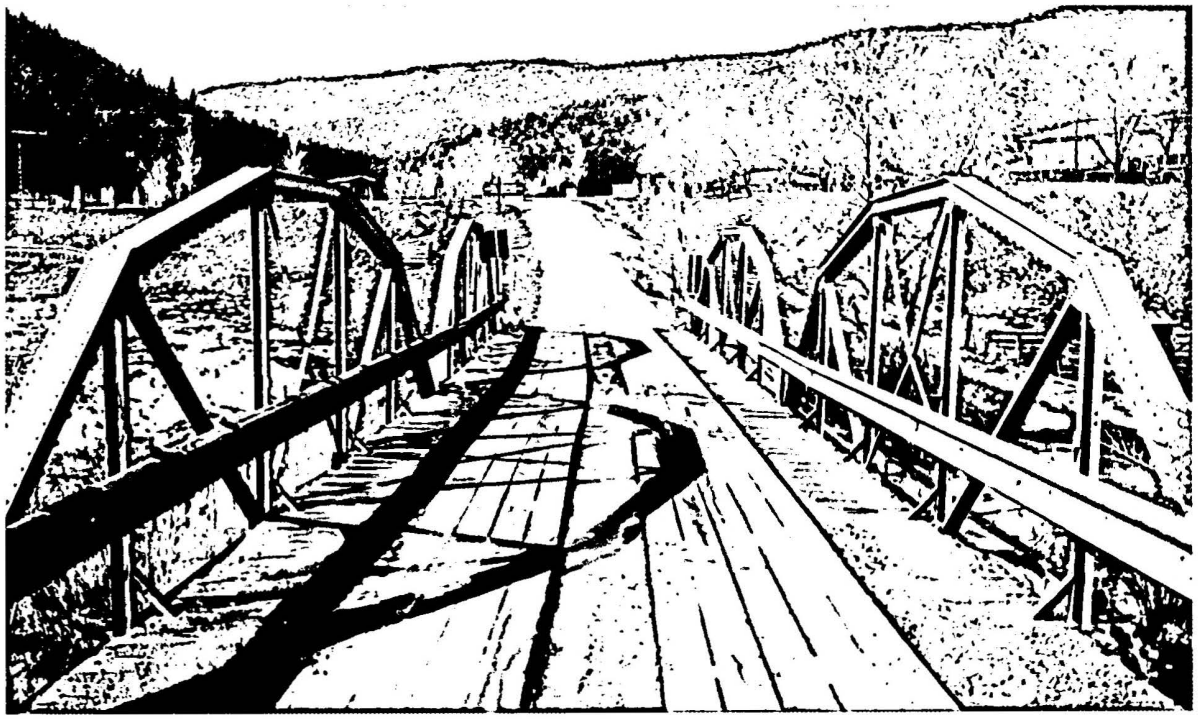


Fig. 45. **Gallinas River Bridge at Montezuma** (No. 900)

bridge was probably constructed shortly thereafter as a county project. The bridge includes two 70-foot spans which are supported by a concrete pier and abutments. A light-weight Parker truss with five panels of 14 feet each was used in the bridge design. This bridge adjoins the Montezuma Historic District and is a good example of the pony truss bridges which were once common on county and secondary roads in New Mexico. (Figure 45)

Rio San Jose Bridge*

No. 1778
I-40 Frontage Road near McCartys
Cibola County

The malpais area running from Grants to McCartys is known for its expanse of rocks and fissures remaining from a prehistoric lava flow. Road construction was difficult in the early days because of the absence of a suitable roadbed. The Rio San Jose Bridge was completed in 1936 on the edge of the malpais area near McCartys. This bridge is a steel pony truss having a 100-foot length. It was well suited for the short crossing over the rock canyon of the Rio San Jose at this location.

The Rio San Jose Bridge was designed by the State Highway Department and erected by the Skousen Brothers. The truss is of a Parker design with a polygonal top chord. This bridge is presently used on a frontage road of I-40.

Rio San Jose Bridge

No. 2540
Private Road near Correo
Cibola County

This 100-foot long pony truss was completed in 1934 and served for many years on US 66 west of Albuquerque. A Parker design was used in its construction. This bridge is supported on each end by a concrete abutment tied into a rock ledge. The bridge at Correo was abandoned upon completion of I-40 and is now used for a private road.

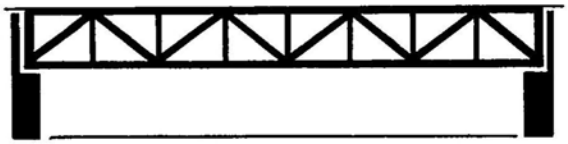
Arroyo Aguaje Bridge

No. 3806
US 64 near Tres Piedras
Taos County

Tres Piedras was established in 1879 as a water stop for steam locomotives on the Denver and Rio Grande Railway. It was named for the three large outcrops of granite located near the community. The Arroyo Aguaje Bridge is located about one mile east of Tres Piedras over a small but steep rock canyon.

This bridge is a steel pony truss span and is well suited for this site. It has a length of 100 feet and a 24-foot roadway. It was completed in 1934 as a National Recovery Project and is an example of the steel pony truss bridges

which were built during the 1930s in New Mexico.



Steel Deck Truss

The truss system for a deck truss bridge is located underneath the bridge floor with the top chords carrying the traffic load. The Warren truss design, with its characteristic triangular panels, was normally used for deck truss construction. The use of a deck truss is limited to sites such as across deep canyons where adequate clearance for the truss is available under the roadway.

Each of the seven deck truss bridges remaining in New Mexico are of a Warren design, except the Rio Grande Gorge Bridge which is a continuous deck truss of special design.

Rio Grande Gorge Bridge*
No. 6462
US 64 near Taos
Taos County

Although the Rio Grande Gorge Bridge is often referred to as a steel arch bridge because of the appearance of its main span, it is more properly described as a continuous steel deck truss. This bridge has truss spans of 300, 600 and 300 feet and a 36-foot steel I-beam approach span at each end. It has a total length of 1272 feet and a 28-foot roadway. It was fabricated by the American Bridge Company and erected by J. H. Ryan and Son in 1965. A high line spanning the gorge was used to position the steel box beam members during its construction. The total cost of the bridge was $2,153,000.

The Rio Grande Gorge at this location is 1200 feet wide and 600 feet deep. The steel deck truss is attractively positioned across the gorge and its appearance is very compatible with its surroundings. The Rio Grande Gorge Bridge was designed by the New Mexico State Highway Department Bridge Design Section and it won first place for the most beautiful span in 1966 in competition sponsored by the American Institute of Steel Construction. This bridge is an outstanding example of modern bridge construction in the western United States. Although this bridge is relatively new, it is included in the survey as an exception because of its engineering significance and beauty. (Figure 46)

Percha Creek Bridge*
No. 1519
NM 90 near Hillsboro
Sierra County

In order to complete a good highway across the Black Range connecting the mining districts of Hillsboro and Silver City, a special two mill levy was passed by the State Legislature

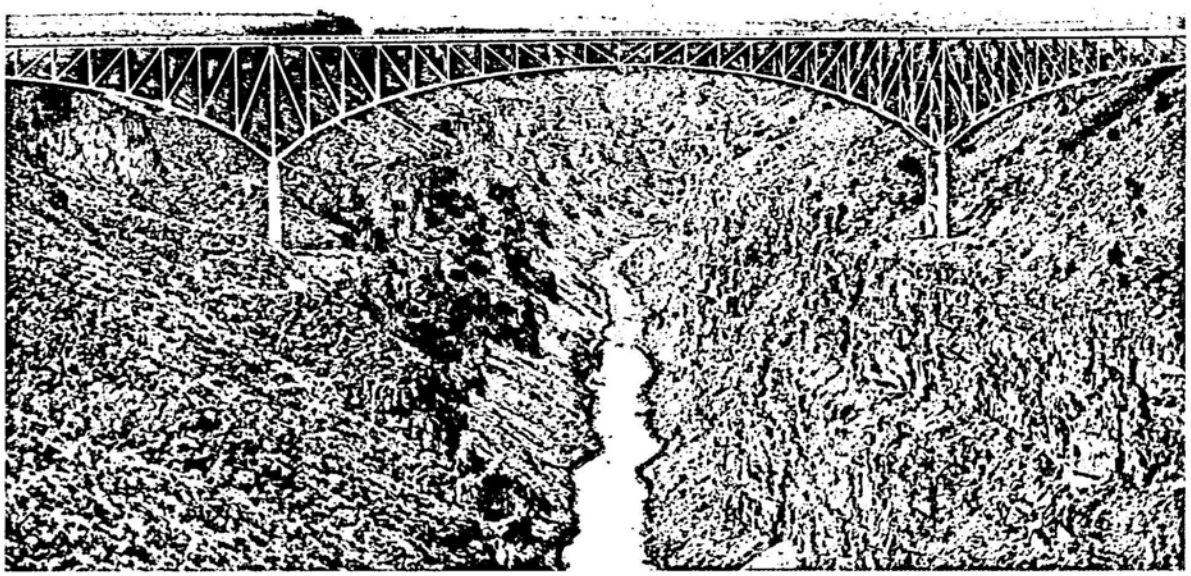


Fig. 46. **Rio Grande Gorge Bridge** (No. 6462)

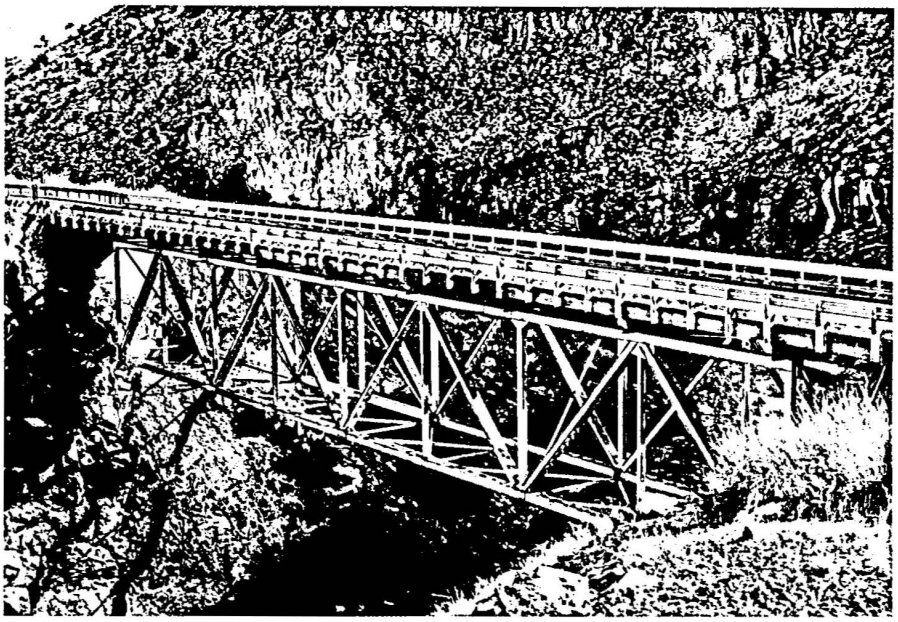


Fig. 47. **Percha Creek Bridge** (No. 1519)

for Grant and Sierra counties. The proceeds of the mill levy were used as the state share to match federal aid funds to complete the project.

The route selected for the highway over the Black Range passed over a number of watercourses and steep canyons. Three major bridge structures were required over Percha Creek between Hillsboro and Kingston in order to complete the road. The greatest obstacle along the route was the crossing over the canyon located about two miles west of Hillsboro. At this site, the New Mexico State Highway Department selected a steel deck truss.

The deck truss over Percha Creek is of a Warren design with four panels of 40 feet each. A 25-foot timber approach span is located on each end of the deck truss providing a total bridge length of 210 feet. This bridge was completed in 1927 by the Ware Company of El Paso. William S. Henderson served as project engineer for the Highway Department during its construction. This bridge is the earliest known steel deck truss remaining in New Mexico. (Figure 47)

San Francisco River Bridge*

No. 2211
US 180 near Luna
Catron County

This bridge is located on US 180 near the Arizona border west of Luna, New Mexico. The site is over a deep canyon which allowed the use of a steel deck truss to complete the crossing. The San Francisco River Bridge near Luna includes a 122-foot Warren deck truss and two 33-foot steel beam approach spans. The total length of the bridge is 188 feet. The bridge was designed by the Bureau of Public Roads and constructed in 1934 as a Forest Service project.

Canadian River Bridge

No. 5285
US 54 at Logan
Quay County

The first bridge spanning the Canadian River Canyon at Logan was a 734-foot steel arch structure constructed in 1922 by the Midland Bridge Company. Upon its completion, it was acclaimed as a major engineering achievement. It was also recognized as an important structure on the Atlantic-Pacific Highway which was an early transcontinental route extending from New York to Los Angeles. (Figure 13)

In 1954, the original steel arch was replaced by the present steel deck truss bridge. The total length of this bridge is 726 feet and it includes three 192- foot truss spans and three 50-foot steel I-beam spans. A Warren truss design was used for the deck trusses which are supported by concrete piers. In recent years, the bridge has been remodeled and a new light-weight deck has been added.

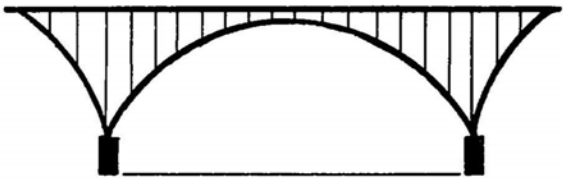
The Canadian River Bridge was designed by the Highway Department's Bridge Design Section and was erected by J. H. and N. M. Monaghans. This bridge is one of the largest steel truss highway structures in the state and it is attractively situated over the Canadian River Canyon.

Nogal Canyon Bridges
Nos. 6776 & 6777
I-25 near Elephant Butte Reservoir
Socorro County

Two parallel deck truss bridges were constructed on I-25 over Nogal Canyon in 1968. Each bridge includes a 265-foot Warren deck truss and two 54-foot steel beam approach spans. Each bridge carries two lanes of one-way traffic. The bridges were fabricated by Robberson Steel Company and erected by Schultz and Lindsay Construction Company. These bridges are examples of steel truss construction adapted for modern highway use.

Seboyeta Creek Bridge
No. S-98
NM 297 at Seboyeta
Cibola County

This bridge is a portable deck truss with pinned connections. The bridge is 87 feet long and has a 32-foot roadway. Six panels having a Warren truss design are pinned together to form this bridge. Markings on the bridge indicate that it was a military bridge assigned to the Marine Corps Supply Center at West Yermo, California. The Seboyeta Creek Bridge is believed to have been obtained and installed by a uranium mining company for access to some of its properties east of the community of Seboyeta.



Steel Arch

The arch design is one of the most attractive structural forms adapted for bridge use. Steel two-hinged arches are generally applicable for bridges from 600 to 900 feet in length. The arch design reduces the bending moment in the structure but requires foundations which are capable of carrying large horizontal thrusts. Arch construction is specialized and usually proceeds from each end until the bridge is joined at the center.

The first steel arch bridge known to have been built in New Mexico was located over the Canadian River at Logan. It was replaced in 1954 by the present deck truss and was later demolished. Information concerning this bridge is included in the description of the Canadian River Bridge (No. 5285) listed under the Warren Deck Truss heading of this section. Only one steel arch bridge remains in New Mexico and it was built at Los Alamos as a federal project by the Atomic Energy Commission.

Los Alamos Canyon Bridge*
No. 7622
NM 4 at Los Alamos
Los Alamos County

One of the largest and most impressive bridge structures in the state is the steel arch bridge over Los Alamos Canyon. This bridge connects Los Alamos National Laboratory technical areas with residences and businesses located at Los Alamos townsite. Prior to its construction, the technical areas were reached by way of a looping road which dropped down into Los Alamos Canyon and then back up to the other side. This road was both inconvenient and dangerous due to the steep grades. Under the leadership of Carroll Tyler, Atomic Energy Commission manager of the Laboratory, funds were obtained and the bridge across the canyon was completed in 1951.

The Los Alamos Canyon Bridge is 820 feet in length and consists of a 442.5-foot arch span and six other spans of 62 feet each. At its center point, the bridge is 180 feet above the canyon floor. The bridge is constructed of steel box beams and has a concrete deck which now carries four traffic lanes and a sidewalk.

The designer of the bridge was Finney and Turnipseed of Topeka, Kansas. The bridge was fabricated by the American Bridge Company and erected by Vinson Construction Company of Phoenix, Arizona, at a cost of $850,000. Although this bridge is less than 40 years old, it has been included in the survey as an exception because of its association with the early days of atomic research at Los Alamos, and because of its engineering significance. (Figure 48)

Steel Beam

Steel I-beam bridges with concrete piers

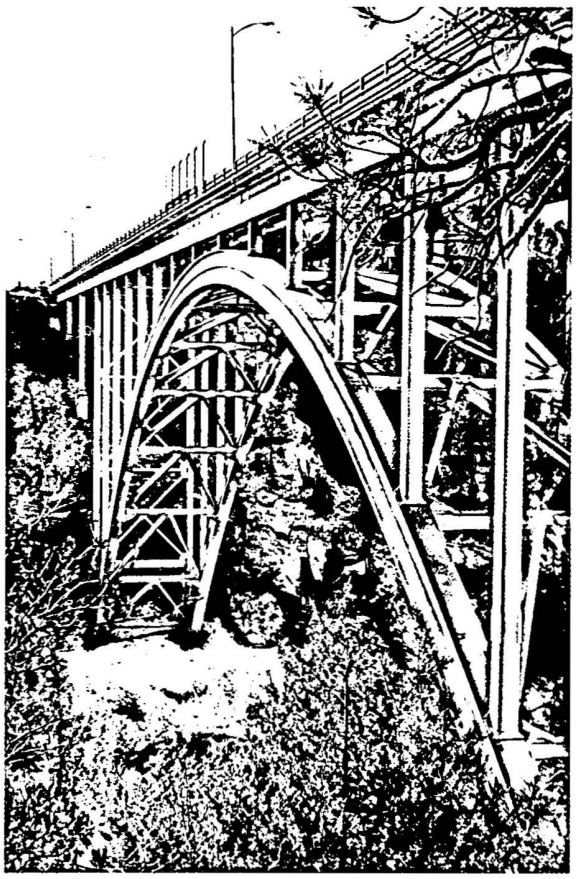


Fig. 48. Los Alamos Canyon Bridge (No. 7622)

and abutments gained widespread use by the New Mexico Highway Department during the later 1930s. A standard design using 30- inch I-beams and 50-foot spans was preferred by the Highway Department at many locations. Although steel I-beams for bridge construction were available much earlier, the Highway Department was probably reluctant to use this bridge design until later because of the higher initial cost over timber beam construction.

Steel I-beam bridges also gained popularity in New Mexico for use as railroad overpasses and provided a marked advantage over timber construction since the steel beams would not be susceptible to fire from cinders from steam locomotives. A number of railroad overpasses were built in New Mexico during the 1930s with steel beams and concrete piers because federal funding was available for these projects.

There are hundreds of steel beam bridges in use in New Mexico at the present time on state, county and municipal roads. The following 10 bridges are examples of steel beam bridges built prior to World War II. These examples also include two railroad overpasses built for convenience and improved public safety.

Galisteo River Bridge*

No. 166
County Road 33 at Galisteo
Santa Fe County

The site of Galisteo was originally settled as an Indian Pueblo. During the early 1600s, a Spanish mission was established at Galisteo but it was later abandoned because of the Pueblo Revolt of 1680. In 1706, Galisteo was re-established by the Spanish and has survived as a small rural community to the present time.

The Galisteo River Bridge is a steel I-beam bridge and has five spans of 40 feet each. The total length of the bridge is 202 feet and it has an 11-foot roadway. The steel I-beams were fabricated by the American Bridge Company and the bridge was completed in 1927 by James Harvey.

This bridge is an early example of a steel I-beam bridge construction in New Mexico and it is unusual because it is supported by timber piers and has a timber deck instead of the customary concrete. The site of the bridge adjoins the old settlement of Galisteo which has been designated as a Historic District. (Figure 49)

Rio Grande Bridge

No. 1704
US 70 at Las Cruces
Dona Ana County

The Rio Grande Bridge at Las Cruces was completed in 1931 during the term of Governor Authur Seligman. This bridge is unusual in that it is composed of timber piers, steel beam spans and a concrete deck and guardrails. A total of five 24-inch I-beams were used as stringers under the driving lanes and one 18- inch I-beam was used under the sidewalk. The bridge includes 16 spans of 31 feet each and has a total length of 496 feet.

The Rio Grande Bridge at Las Cruces was designed by the State Highway Department and was built by R. E. McKee. It represented a major highway structure for its day and is noted for its unusual combination of construction materials.

Coal Avenue Viaduct

No. 1773
Coal Avenue, Albuquerque
Bernalillo County

The Coal Avenue Viaduct is a massive steel

beam and concrete structure completed in 1936 over the Santa Fe Railway yards near downtown Albuquerque. The viaduct replaced an earlier structure built about 1900. The present structure includes 17 spans and has a total length of 914 feet. A system of cantilever and suspended beams with link and pin connections is utilized to support the concrete deck. Attractively constructed concrete piers are located between the railroad tracks to support the bridge beams.

The Coal Avenue Viaduct was one of a number of grade crossing elimination projects in New Mexico funded by the federal government during the 1930s. The viaduct was designed by the State Highway Department and constructed by W. E. Bondurant of Roswell. It is a good example of the large scale New Deal municipal projects which were built to provide employment and to improve public safety.

Galisteo River Bridge

No. 1782
NM 41 near Galisteo
Santa Fe County

This bridge was constructed in 1936 by A. O. Peabody at a site about one-half mile south of the community of Galisteo. It is a steel I-beam bridge with concrete piers and abutments. It includes four 60- foot spans and has a total length of 240 feet. Each span is constructed of five 36-inch I-beams which support the concrete deck. This bridge is an early example of "modern" steel I-beam construction which was used extensively by the New Mexico State Highway Department after World War II.

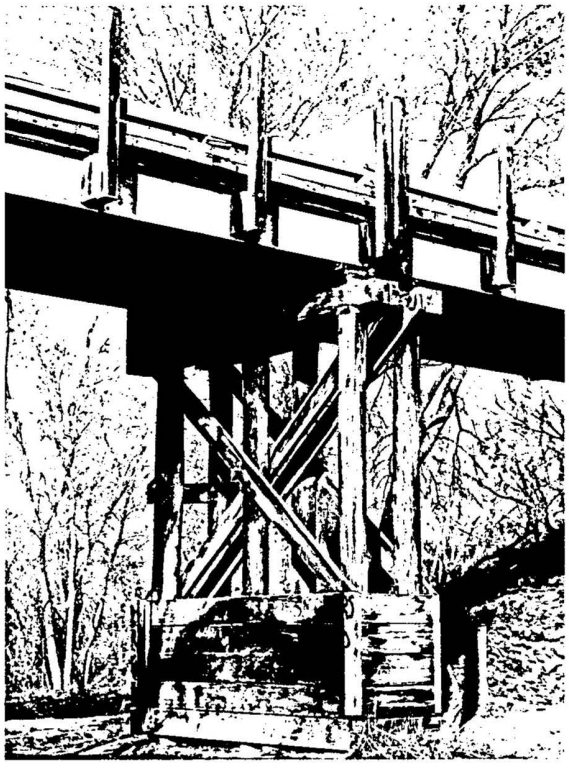


Fig. 49. **Galisteo River Bridge** (No. 166)

Alamosa River Bridge

No. 1796
I-25 Frontage Road near Truth or Consequences
Sierra County

The Alamosa River Bridge was by-passed by I-25 and is now located at the end of a frontage road. This bridge is a steel I-beam bridge with seven spans of 50 feet each and a total length of 350 feet. It was completed in 1937 by Hayner and Burn, and is an example of steel I-beam construction which was gaining popularity in New Mexico at that time. (Figure 50)

San Cristobal Creek Bridge

No. 1814
NM 41 near Galisteo
Santa Fe County

This bridge replaced an earlier steel pony truss bridge over San Cristobal Creek at a site one mile south of Galisteo. It is a steel I-beam bridge completed in 1939 by Henry Thygesen. The bridge includes three 70-foot spans which are very long I-beam spans for that period. This bridge is also an example of steel I-beam bridge construction which was preferred by the Highway Department during the late 1930s and following World War II.

Tucumcari Overpass

No. 1820
NM 104 at Tucumcari
Quay County

The Tucumcari Overpass was completed in 1940 over the Southern Pacific Railway yards in order to provide a safe grade separation for NM 104 north of the city. This overpass is constructed of eight steel beam spans and has a total length of about 500 feet. The concrete deck includes two 12-foot traffic lanes and an eight-foot sidewalk. A curve was included in the overpass plan in order to allow for placement of the structure at right angles to the railroad tracks.

This overpass is an example of a large pre-

World War II bridge structure. The curve included in its design was unusual for this period in New Mexico.

Clines Corners Overpass

No. 1825
US 285 at Clines Corners
Torrance County

Clines Corners is a well-known tourist stop at the junction of I-40 (formerly US 66) and US 285, established by Ray Cline who set up a service station at this site about 1934. This overpass is a steel I-beam structure with concrete piers and abutments. It has spans of 40, 62, 44, 62 and 40 feet and a total length of 248 feet. The first section of the overpass was completed in 1940. In 1955, it was extended to its present length. The Clines Corners Overpass is reported to be the first highway grade separation in the state.

Rio Grande Bridge

No. 1836
Oñate Street, Española
Rio Arriba County

Construction bids were opened for the Rio Grande Bridge at Española on October 29, 1940, and it was completed the following year. The contractor for the project was Sanders Brothers Construction Company. This bridge was built as a Federal-Aid Project and it was one of the last major highway structures completed in New Mexico prior to the United States entering World War II.

The Rio Grande Bridge was constructed of steel I-beams and concrete piers and abutments. This bridge includes fourteen 60-foot spans and two 35- foot approach spans, and has a total length of 920 feet. It is an early example of the modern I-beam design which was used extensively by the Highway Department during the 1950s and 1960s.

Bataan Memorial Bridge

No. 1838
US 62 at Carlsbad
Eddy County

Between 1940 and 1945, shortages of workers and materials due to World War II forced the curtailment of most road and bridge building in New Mexico except for military purposes. The Bataan Memorial Bridge was constructed as a military access project to the potash mines east of Carlsbad. It was the last major bridge completed by the State Highway Department for the duration of World War II.

This bridge is a steel beam structure with a concrete deck and piers. It includes 8 spans of 50 feet each and has a total length of 400 feet. A newer parallel bridge has been completed and the original bridge now carries two lanes of eastbound traffic across the river.

The original bridge was completed in April, 1942, by W. E. Bondurant at a cost of about $78,000. On July 5, 1942, it was dedicated as the Bataan Memorial Bridge in honor of New Mexico's 200th Coast Artillery, whose men were then prisoners of the Japanese.

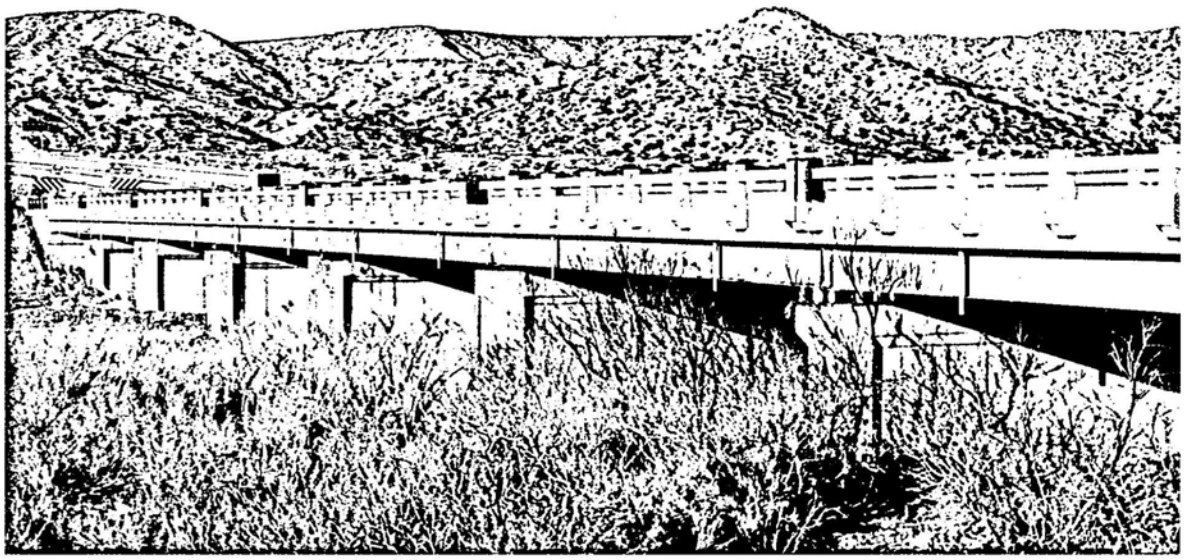
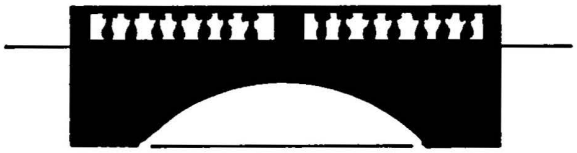


Fig. 50. **Alamosa River Bridge** (No. 1796)



Masonry and Concrete Arches

Although very attractive and durable, masonry and concrete arch bridges were not built in great numbers in the United States. A few small masonry arch bridges and culverts were constructed in New Mexico near the turn of the century. These structures were usually built as municipal projects at communities such as Raton, Las Vegas and Santa Fe where stonecutters had previously been employed for construction of masonry buildings. Construction of concrete arch bridges was limited in New Mexico during the early 1900s due to the cost of transportation and the cost of forming and pouring concrete.

At this time, three masonry arch structures are known to remain in New Mexico. One of these structures located in Raton was widened by the addition of a concrete arch section. Two arch bridges constructed entirely of concrete also remain. The most impressive of these is the Gallinas River Bridge on Bridge Street in Las Vegas.

Gallinas River Bridge*

No. 1549
NM 65 at Las Vegas
San Miguel County

Bridge Street provided the link between the two communities which developed into present day Las Vegas. West Las Vegas, also known as Old Town, was established in 1835 as a Spanish settlement by settlers arriving from San Miguel del Bado on the Pecos River. This settlement grew up around the central plaza which served as the focal point of the community. West Las Vegas also prospered in its early years due to its position as a stop and trade center along the Santa Fe Trail. In 1879, the Santa Fe Railway entered the area one mile east of the Old Town plaza and a new community immediately began to prosper around the commercial activity brought about by the railroad. Buildings were constructed and businesses were established along Bridge Street following the entry of the railroad.

The existing bridge on Bridge Street was constructed of two concrete arch spans and replaced an earlier steel through truss. It has a total length of 154 feet and a roadway of 44 feet. This bridge was completed in 1909 by the Missouri Valley Bridge and Iron Company of Leavenworth, Kansas, at a cost of $32,000. In addition to vehicular traffic, the bridge carried electric trolley cars until 1926. (Figure 10)

This bridge is an example of an early concrete bridge built in the territorial days before statehood in 1912. It is known for its attractive arch design and decorative concrete railings. Its style and appearance is consistent with the surrounding buildings and it has been included in the Bridge Street Historic District. It is also the longest concrete arch bridge remaining in New Mexico. (Figure 51)

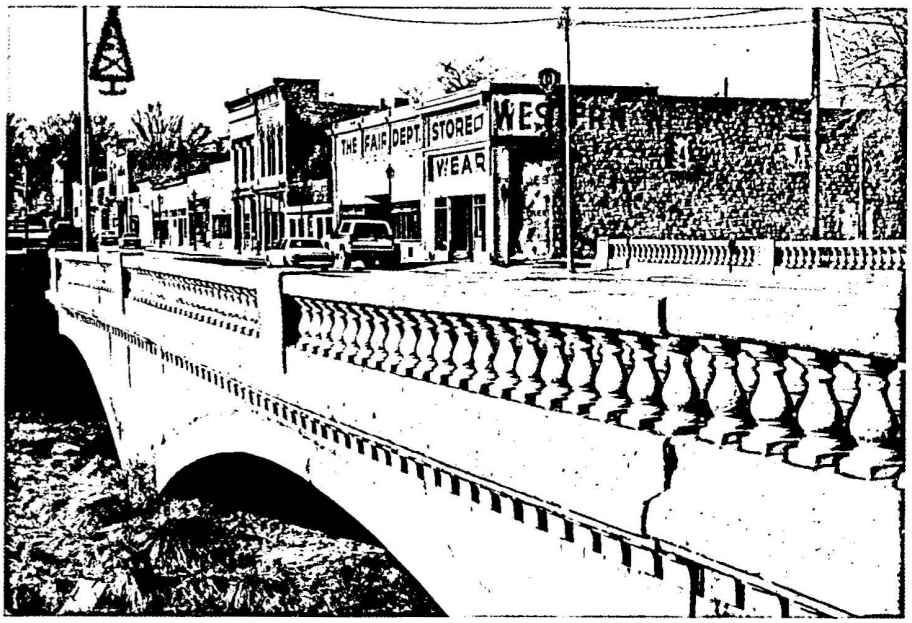


Fig. 51. Gallinas River Bridge at Las Vegas (No. 1549)

Hot Springs Boulevard Culvert*
No. S-44
Hot Springs Boulevard,
Las Vegas
San Miguel County

This structure is a masonry arch culvert located over an arroyo on Hot Springs Boulevard in Las Vegas. This boulevard served for many years as the main connection between West Las Vegas and the Montezuma Hotel and Hot Springs located northwest of the town.

The Hot Springs Boulevard Culvert has an arch opening of 18 feet and a total width of 188 feet. It was constructed of a brown sandstone and was completed as a county project in 1888. This culvert is located near the Las Vegas Plaza Historic District and represented a major public works project upon its completion. The Hot Springs Boulevard Culvert is the oldest known bridge structure remaining in New Mexico. (Figure 52)

North 1st Street Bridge*
No. 7546
North 1st Street, Raton
Colfax County

Raton was established as the Santa Fe Railway entered New Mexico from Colorado in 1879. Raton was a major railroad and coal mining center during the late 1800s and early 1900s. During this period, a number of attractive masonry buildings including the Palace Hotel were constructed in Raton by immigrant stonecutters.

The North 1st Street Bridge is one of only a few masonry arch bridges constructed in New Mexico. It has a length of 73 feet and an arch opening of 28 feet. Some of the stones used in its construction ranged up to eight feet in length. This bridge, completed in 1903 by Walter Sharp, is an excellent example of an early masonry bridge and stonecutting craftsmanship.

North 2nd Street Bridge
No. 4872
North 2nd Street, Raton
Colfax County

The North 2nd Street Bridge has a length of 51 feet and an arch opening of 48 feet. The original masonry bridge was widened from 20 feet to 33 feet by the addition of a concrete arch section.

The builder and completion date of the original structure are not known but early photographs of the city indicate that its construction was sometime after the completion of the masonry bridge on North 1st Street. The North 2nd Street Bridge is also a good example of an early masonry structure although it has been altered by the addition of the concrete section.

Don Gaspar Avenue Bridge*
No. 3023
Don Gaspar Avenue, Santa Fe
Santa Fe County

The Don Gaspar Avenue Bridge was built across the Santa Fe River in 1934 with federal funds under the National Recovery Municipal Program. This bridge is a concrete arch bridge and has a length of 52 feet. The attractive shape and lines of the bridge fit in well with its setting along the Santa Fe River Park between downtown and the capitol area.

This bridge was featured in the introduction of the 1933-1934 *Biennial Report of the State Highway Engineer.* It is located within the Santa Fe Historic District and is unusual

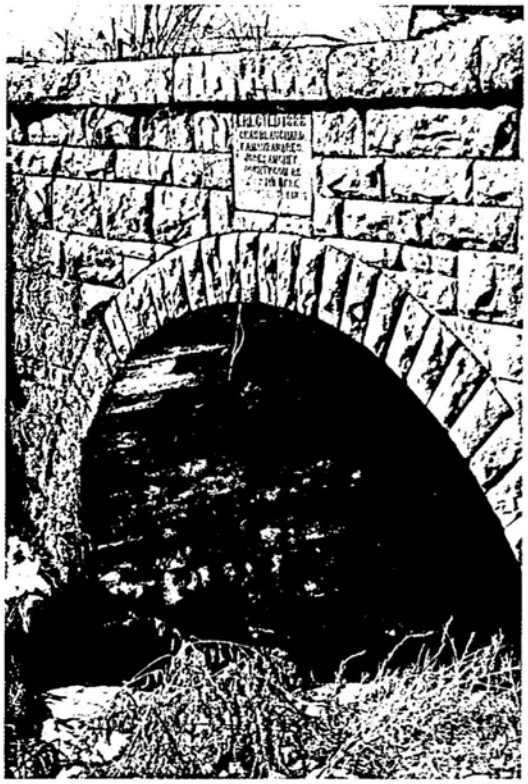
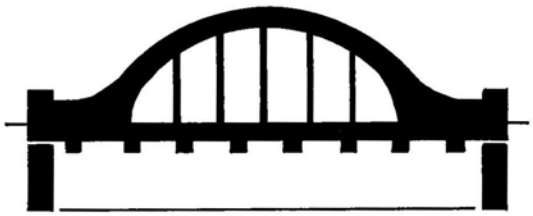


Fig. 52. **Hot Springs Boulevard Culvert** (No. S-44)

because of its arch design. It is also a good example of a number of municipal public works projects built in New Mexico during the 1930s.



Concrete Rainbow Arch

The concrete rainbow arch is based upon a design patented by James Marsh in 1912. A concrete arch is located on each side of the roadway to support the bridge deck by means of vertical concrete members. Since concrete is not a good material for carrying tension, adequate steel reinforcement was necessary for the vertical members to support the deck. This design became popular in the Midwest during the 1920s for spans of 50 to 150 feet.

Only one concrete rainbow arch is known to have been built in New Mexico and it remains in use as a one-lane bridge in Santa Fe.

Bridge of the Hidalgos*

No. 701
Grant Avenue, Santa Fe
Santa Fe County

The Bridge of the Hidalgos is located on Grant Avenue over Arroyo Mascaras in Santa Fe. This bridge is a concrete rainbow arch constructed in 1920 by the Midland Bridge Company. It has a total length of 54 feet and a 16-foot roadway. A four-foot wide sidewalk is located on the outside of each arch.

The Bridge of the Hidalgos is the only known concrete rainbow arch built in New Mexico. It is presently in use carrying limited traffic on Grant Avenue and it has been recognized for its unique design by being listed on the State Register of Cultural Properties. (Figures 53 & 54)

Concrete Truss

A truss bridge is generally thought of as a framework of steel members, some of which react to loads in tension and others in compression. The use of concrete for truss construction is most unusual because of its weight and poor tensile strength. This shortcoming was overcome by the addition of large steel reinforcement rods. The method of construction was also unique in that the truss systems were poured in a molding form and then lifted into place.

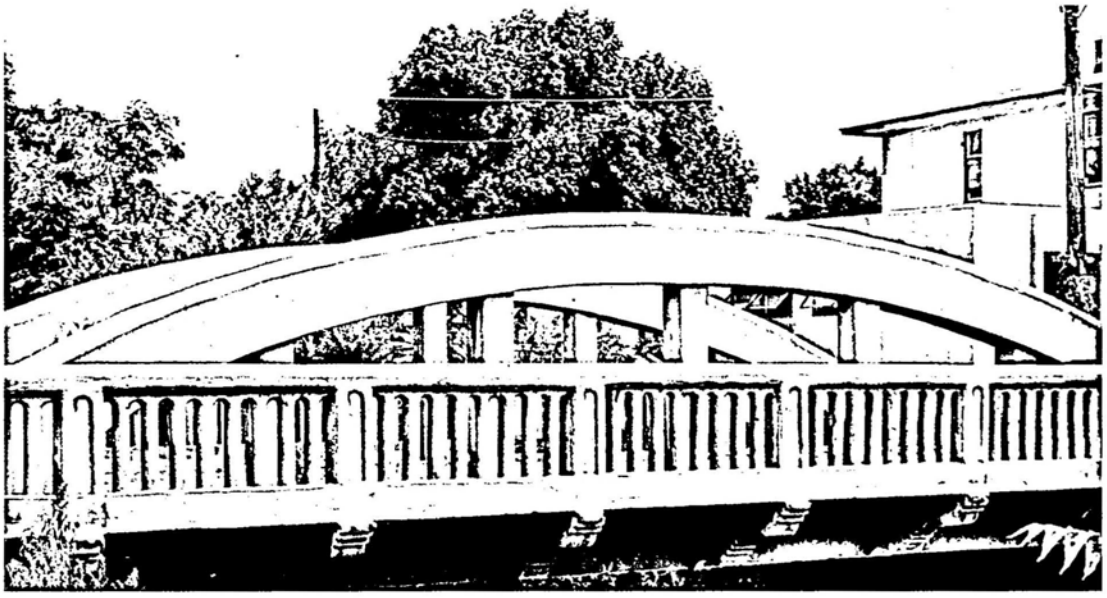


Fig. 53. **Bridge of the Hidalgos** (No. 701)

Fig. 54. **Bridge of the Hidalgos Inscription** (No. 701)

This design was first introduced in New Mexico by the Missouri Valley Bridge and Iron Company under the general supervision of George E. Morrison, civil engineer of East Las Vegas, acting in behalf of San Miguel County. The first bridge of this type was completed over the Gallinas River at Las Vegas in 1914. The county government appeared to favor this bridge design and selected it for construction at three other known sites. Two of these bridges in San Miguel County remain operational at this time. The other bridge remains intact but it is not usable because the timber approach spans have washed out. The original concrete truss bridge built at Las Vegas under Morrison no longer exists.

Variadero Bridge*

No. 3964
NM 104 at Variadero
San Miguel County

This bridge was constructed over the Conchas River by the Missouri Valley Bridge and Iron Company probably between 1915 and 1920. It was completed as a county project under the supervision of J. B. Franzini, County Engineer.

A concrete pony truss design was used for this bridge. It includes four 50-foot spans and a 15-foot roadway. Each span consists of two reinforced concrete truss sections connected by concrete floor beams and a deck. The concrete for the bridge is said to have been mixed by hand at the site and poured into molds. The completed trusses, floor beams and deck were lifted into place after the concrete had gained sufficient strength.

The Variadero Bridge was by-passed in 1966 and it is now used as access to several homes. This bridge is the largest of four concrete truss bridges known to have been constructed in San Miguel County during the early 1900s. Its design is unique since reinforced concrete is not normally associated with truss construction because of its poor tension carrying ability. The Variadero Bridge is noteworthy because of its unusual design and pre-cast construction. (Figure 55)

El Cerrito Bridge*

No. 4962
County Road 28-A at El Cerrito
San Miguel County

This bridge is also a concrete pony truss and is located over the Pecos River at the community of El Cerrito. It includes two 55-foot truss spans and four 15-foot timber approach spans. The total length of the bridge is 170 feet.

The Pecos River Bridge at El Cerrito is similar in design and construction to that of the Variadero Bridge. It is presently in use on a county road and provides the only access across the Pecos River to El Cerrito.

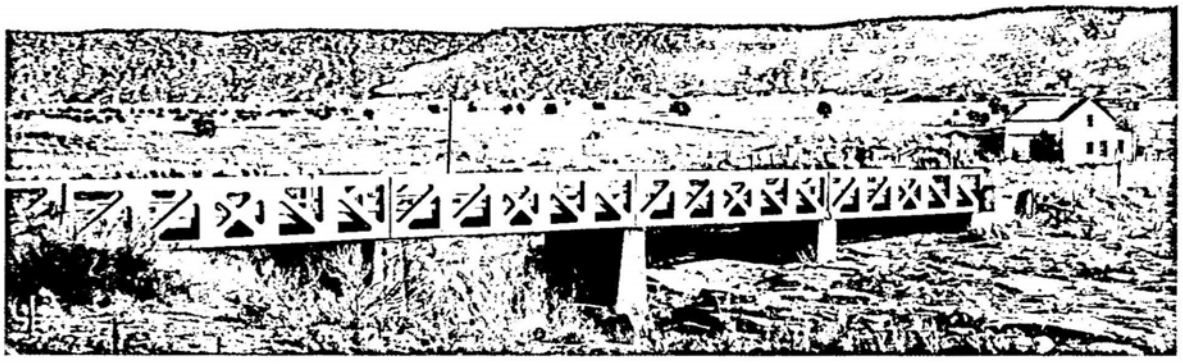
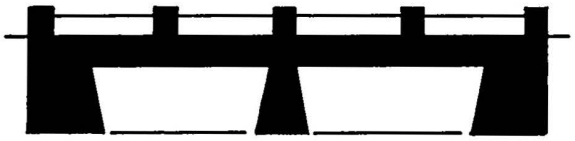


Fig. 55. **Variadero Bridge** (No. 3964)

Isadora Bridge
No. 877
Private Road near Isadora
San Miguel County

This site includes the remains of a concrete pony truss bridge similar in design to that of the bridges at Variadero and El Cerrito. It has three spans of 50 feet each supported by concrete piers. The timber approaches at each end of the bridge have been washed out and the bridge now stands alone in the middle of the streambed.

The Isadora Bridge was constructed by the Missouri Valley Bridge and Iron Company under the supervision of J. B. Franzini, County Engineer. Plans for the bridge were approved by State Engineer James A. French in 1917. The bridge has been abandoned and the site is now located on a privately owned ranch.



Concrete Beam

The use of concrete beam bridges gained popularity in the United States after the turn of the century as steel reinforcement was improved. Construction of concrete beam bridges came later in New Mexico because of the cost of transportation and pouring concrete. Steel truss and steel beam bridges with concrete piers and abutments were usually preferred by the State Highway Department over the use of concrete beams during the 1930s. The first large scale use of concrete beam bridges in New Mexico was by the International Boundary Commission in 1941. The Commission utilized a standard pre-cast design to complete eight bridges across the Rio Grande as part of channel improvements in southern New Mexico and Texas.

There are now hundreds of concrete beam and slab bridges in use in New Mexico. The following examples were selected as representative of this type of bridge construction.

Cameron Creek Bridge
No. 1315
Maple Street, Central
Grant County

This bridge was completed in 1922 and is constructed entirely of reinforced concrete. It includes three spans of 31 feet each and has a total length of 93 feet. The roadway of this bridge is only 17 feet wide due to its early date of construction.

The Cameron Creek Bridge was constructed as a Federal-Aid Project and it represents an early example of concrete bridge construction in New Mexico.

Maria Chavez Arroyo Bridge
No. 8
US 85 near Algodones
Sandoval County

This bridge is a concrete structure completed in 1927. It includes two 40-foot concrete spans and a concrete pier and abutments. The roadway of the bridge is 20 feet in width. The guardrails along each side of the bridge were renovated in 1958. This bridge is located on US 85 and is also an example of early concrete bridge construction in New Mexico.

Delgado Street Bridge*
No. 4075
Delgado Street, Santa Fe
Santa Fe County

This bridge is a concrete structure completed across the Santa Fe River in 1928. It has a 40-foot span and 20-foot roadway. The concrete beams and deck appear to have been poured in place. The Delgado Street Bridge is typical of the small concrete bridges which were built for municipal use prior to World War II. The site of this bridge adjoins the Santa Fe River Park and is located within the Santa Fe Historic District. (Figure 56)

Brushy Canyon Culvert
No. S-110
US 180 near Alma
Catron County

This 19-foot long structure is a simple concrete slab supported by masonry abutments. The masonry is of attractively cut stone and the concrete slab remains in good condition. It is typical of the small bridges and drainage structures built during the 1930s on Forest Service lands to provide employment and improved public roads. This bridge has been by-passed by the State Highway Department and is no longer in use.

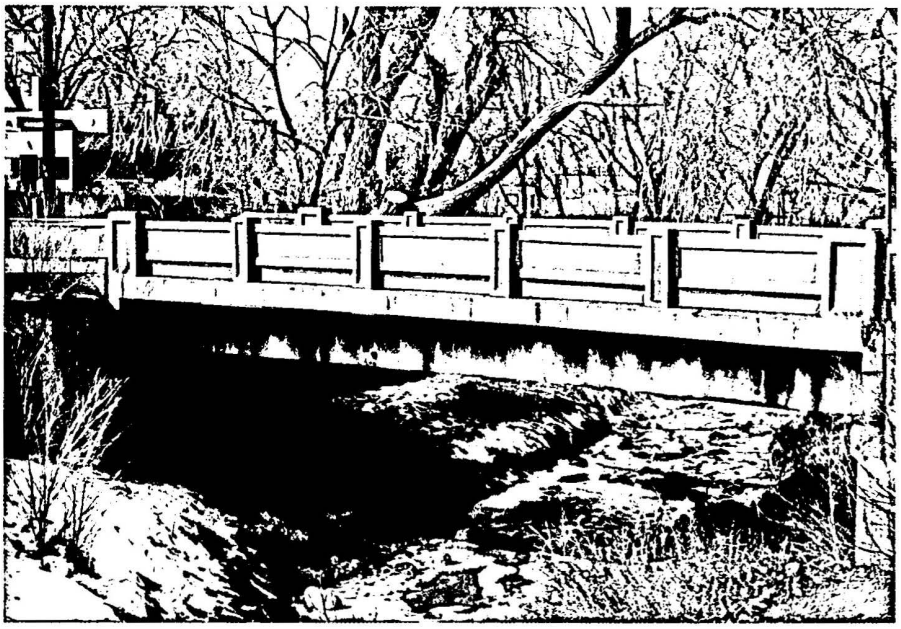


Fig. 56. Delgado Street Bridge, Santa Fe (No. 4075)

New Mexico Avenue Culvert
No. S-46
New Mexico Avenue, Las Vegas
San Miguel County

The New Mexico Avenue Culvert is an example of the small labor intensive projects completed in the state during the depression era. This structure has an opening of 14 feet in width and a total length of 88 feet. The channel walls of the culvert are constructed of cut stones. The span over the opening is a concrete slab. A dedication plaque is located on the west headwall and is inscribed with the words "Built by W.P.A. 1942".

Rio Grande Bridges
Nos. 2873, 4263, 4264, 4283, 4551 & 4552
International Boundary Commission
Dona Ana County

During the late 1930s and early 1940s, a major canalization and bridge building project was completed on the lower Rio Grande by the International Boundary Commission. The project included construction of eight concrete bridges from Hatch to El Paso.

Standard plans were prepared by the Boundary Commission for the Country Club, Borderland, Vinton, Berino, Vado, Mesquite, Shalem and Hatch-Rincon bridges. Each bridge was constructed with pre-cast concrete pilings. A concrete cap was installed after the pilings were driven into the streambed. Reinforced concrete beams and the deck for each bridge were then installed.

Under the standard Boundary Commission design, each concrete span was 34 feet in length and the roadway was 20 feet wide. Most of the bridges constructed included 14 spans and had a total length of 476 feet.

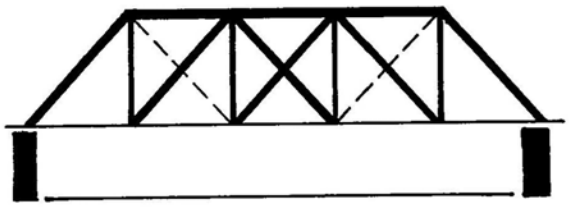
Six of the Boundary Commission bridges located in New Mexico have been recorded. These bridges represent a large-scale federal project in which standard plans were successfully used for the design of similar concrete structures.

Rio Grande Bridge
No. 5484
NM 46 near Corrales
Bernalillo County

The Rio Grande Bridge at Corrales was completed in 1956 by Sharp and Fellows to replace an earlier steel truss bridge. The bridge is constructed of pre-stressed concrete beams supported by steel piers with concrete caps. The bridge is composed of 19 spans of 50 feet each and has a total length of 950 feet.

The Rio Grande Bridge at Corrales was designed by the New Mexico State Highway Department and was the first pre-stressed concrete bridge constructed in the state.

This bridge is located on NM 46 which now serves as a major connecting route between Albuquerque and the communities located west of the Rio Grande.



Timber Truss

The Howe truss was patented by William Howe in 1840 and became a very popular truss design for timber construction. Timbers worked well for the diagonal members of the Howe truss since these members are in compression when a load is applied. Iron rods were used for the vertical members which support the bridge floor and act in tension.

The Howe and other truss designs adaptable for timber construction such as the King Post and Queen Post are known to have been used at a number of locations in New Mexico. During the 1920s and 1930s, there were several timber truss bridges across the Rio Grande in northern New Mexico. At this time, there are three timber truss bridges remaining in the state. The most noteworthy of these bridges is located across the Rio Grande at Embudo.

Rio Grande Bridge*

No. S-19
Private Road at Embudo
Rio Arriba County

Embudo is the site of the first systematic stream gaging station in the United States established in 1888 by order of John Wesley Powell, director of the U.S. Geological Survey and explorer of the Grand Canyon. The station was established to refine stream gaging techniques and to train young engineering school graduates in the art of stream gaging. Embudo was also a water stop for steam locomotives on the Denver and Rio Grande Railway between Antonito, Colorado, and Santa Fe. This site has been designated a Historic District and a Civil Engineering Landmark.

The Rio Grande Bridge at Embudo is believed to have been moved to this site in 1922 from Española. This bridge is a timber pony truss with three spans of 55, 65 and 62 feet, and a total length of 182 feet. It has a Howe truss design with timber diagonals and iron rods for vertical members. A masonry pier and a rock crib pier are used to support the spans. The rock crib pier is built of river stones held in place by logs.

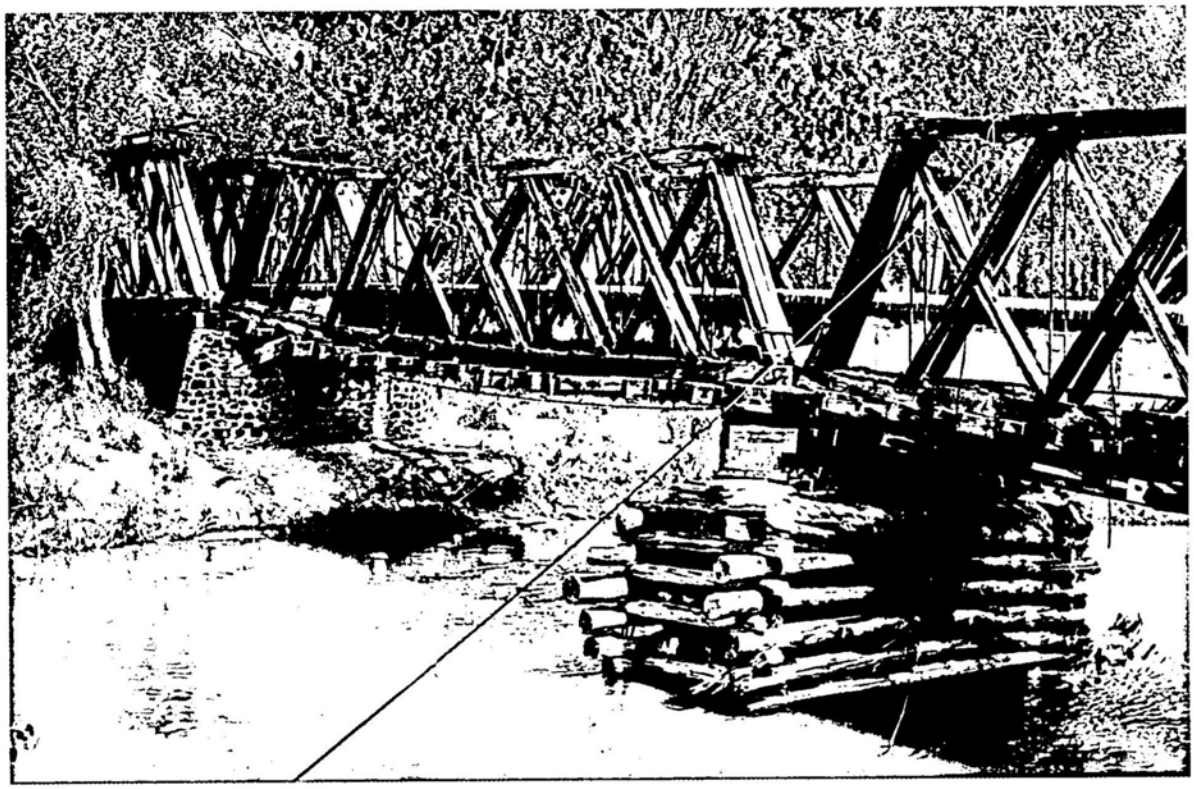


Fig. 57. **Rio Grande Bridge at Embudo** (No. S-19)

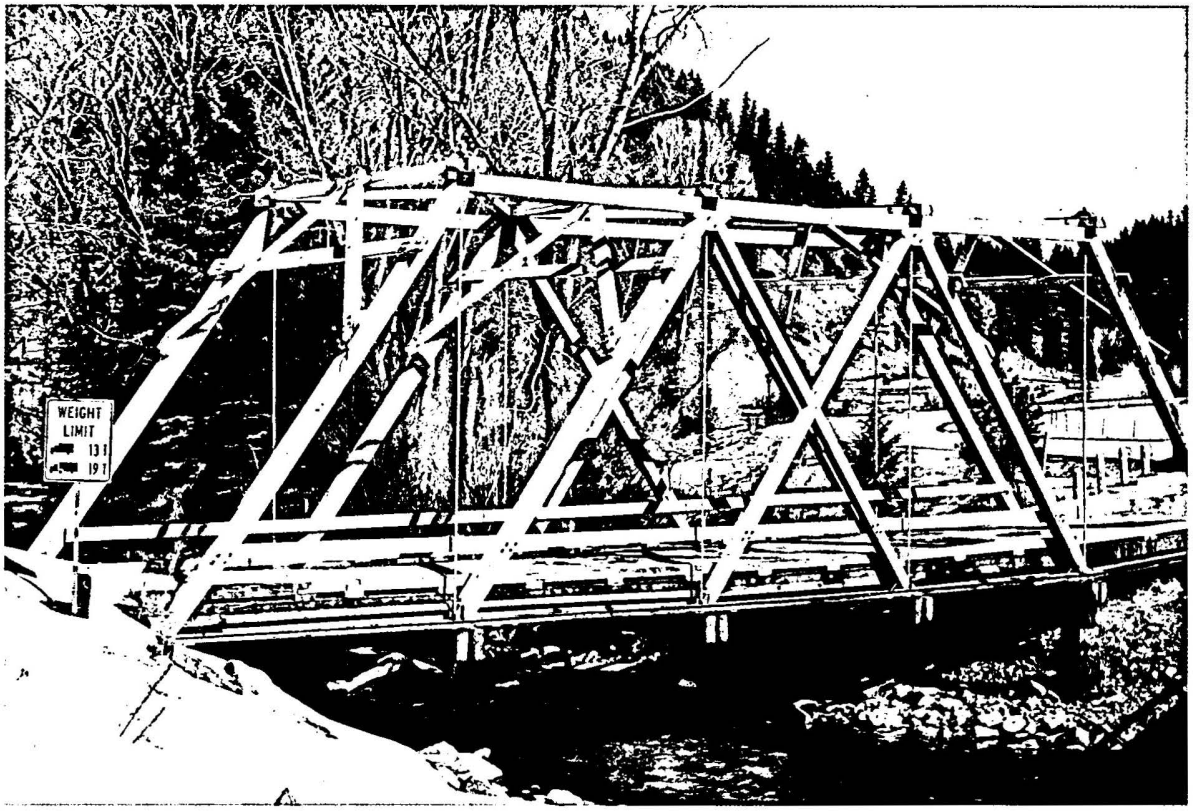


Fig. 58. **Pecos River Bridge at Terrero** (No. 239)

In recent years, steel I-beams were added over the top of the truss deck in an attempt to stabilize the structure and to keep the bridge usable. The bridge at Embudo is now privately owned and it is the last remaining example of the timber truss bridges which were once common across the Rio Grande in northern New Mexico. (Figure 57)

Pecos River Bridge*

No. 239
NM 63 at Terrero
San Miguel County

The Pecos River Bridge at Terrero is a timber through truss originally constructed in 1921 as a Forest Service project. This bridge is one of four timber truss bridges constructed by the Forest Service over the Pecos River above the Village of Pecos. In 1944, the bridge was renovated by Skousen Brothers Construction Company and salvaged railroad rails were installed to replace the bottom chord of the truss. This innovation was featured in the April, 1945, issue of *Roads and Streets Magazine*.

This bridge is a Howe through truss with five panels of 15 feet each and with steel rods used for the vertical members. The total length of the span is 75 feet and the roadway is 15 feet wide. The setting of the bridge is in a high mountain canyon adjacent to the old mining district of Terrero.

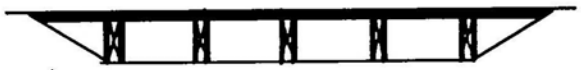
This bridge has been by-passed and preserved in place by the New Mexico State Highway and Transportation Department and it is now used by hikers and horseback riders for crossing the river. The Pecos River Bridge at Terrero is the last timber through truss known to exist in New Mexico. (Figure 58)

Ghost Ranch Bridge

No. S-1
Private Road near Abiquiu
Rio Arriba County

The King Post truss is the simplest of the truss forms with diagonal members in compression and the vertical member in tension. An iron rod was often used as the vertical member.

The Ghost Ranch Bridge was built during the 1970s and is a replica of the timber King Post truss design used at a number of sites in New Mexico during the early 1900s. This bridge is 40 feet in length and has an 11-foot roadway. It is privately owned and the only King Post bridge known to remain in the state.



Timber Beam

The use of timber beams for bridge construction in New Mexico ranged from primitive log spans across small arroyos to timber trestle bridges over 1,000 feet in length. Early timber bridges were often no more than two logs placed across a watercourse with planks nailed to the top to form a single driving lane. During the 1920s, the Highway Department began the use of timber treated with a creosote preservative for bridge construction. Treated timber bridges with standard 25- foot spans were preferred by the Department for crossing the wide flood plains of the lower Rio Grande and other rivers. These bridges were economical and could be easily repaired since new pilings could be added and individual spans could be repaired or replaced.

Although many timber beam bridges have been replaced in recent years, there are still a large number of these structures remaining in use on secondary roads in New Mexico. The following eight bridges represent some of the earliest and longest examples of these structures.

Rio Grande Bridge*
No. 2591
US 85 near Radium Springs
Dona Ana County

The Rio Grande Bridge at Radium Springs is representative of timber trestle bridge construction which reached its peak in New Mexico during the 1930s. This bridge consists of 19 spans of 25 feet each. The total length of the bridge is 475 feet.

The Rio Grande Bridge at Radium Springs was designed by the Highway Department and was completed in 1933. In later years, the roadway was widened to 29 feet. The bridge is located about 15 miles north of Las Cruces and remains in use as a two-lane highway bridge on US 85. The Rio Grande Bridge at Radium Springs is located near the site of Fort Selden, a military outpost established in 1865. This bridge has been included on the State Register of Cultural Properties as an example of the timber trestle bridges constructed in New Mexico. (Figure 59)

Rio Grande Bridge
No. 1669
US 85 near Arrey
Sierra County

The Rio Grande Bridge located on US 85 south of Arrey is a timber trestle bridge complete with timber piers and deck. This bridge is composed of 21 standard spans of 25 feet each and has a total length of 525 feet. It was completed in 1929 and was later widened to 29 feet. It was a major highway structure upon its completion and is an example of timber bridge construction used extensively by the Highway Department during the 1920s and 1930s. (Figure 60)

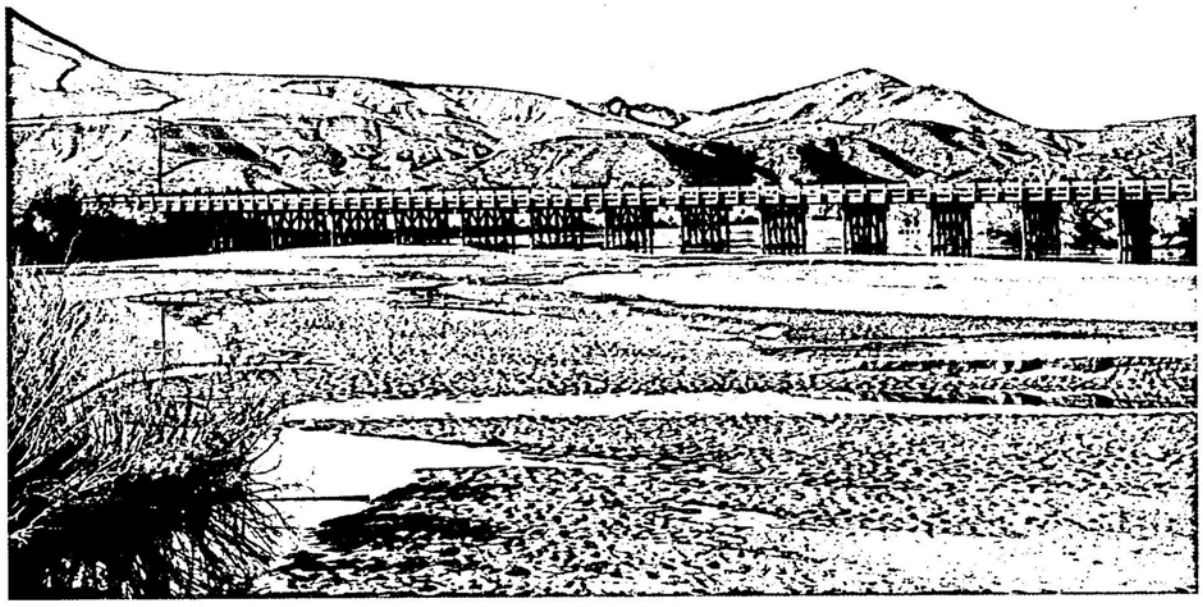


Fig. 59. Rio Grande Bridge at Radium Springs (No. 2591)

Fig. 60. **Rio Grande Bridge near Arrey** (No. 1669)

Trujillo Arroyo Bridge
No. 1666
US 85 near Arrey
Sierra County

This bridge is located on US 85 north of Arrey and includes eight 25-foot spans. Concrete piers were originally constructed to support the timber spans. The bridge was later widened to 29 feet by the addition of a timber piling on each side of the concrete piers. It was completed in 1929 and repaired a number of times in later years due to flood damage.

Rio Grande Bridge
No. 1671
US 85 at Hatch
Dona Ana County

The Rio Grande Bridge at Hatch is also representative of the timber trestle bridges widely used by the Highway Department. This bridge includes 23 spans of 25 feet each and has a total length of 575 feet. It was completed in 1931 and was rebuilt after a fire in 1950. This bridge was later widened from 19 to 29 feet by the addition of new timber pilings.

Rio Grande Bridge
No. 3248
NM 28 near Black Mesa
Dona Ana County

The Rio Grande Bridge near Black Mesa is located in the Mesilla Valley about six miles south of Las Cruces. It is a timber trestle bridge consisting of 14 spans at 25 feet each. The total length of the bridge is 350 feet and the roadway is 23 feet wide.

This bridge was completed in 1934 according to the Highway Department records. It is typical of the timber trestle bridges which were once common over the Rio Grande in southern New Mexico.

Percha Creek Bridge
No. 2510
US 85 near Caballo
Sierra County

The Percha Creek Bridge was built in 1937 as a Bureau of Reclamation Project. The new bridge was necessary because of the channelization of Percha Creek and the construction of Caballo Dam by the Bureau during 1937 and 1938. This bridge is a timber beam bridge with nine spans of 27 feet each and a total length of about 241 feet. Massive concrete piers averaging about twenty feet in height were constructed to support the timber stringers and deck. This bridge was a major highway structure upon completion and it is noteworthy because of its association with the Caballo Dam Project.

Rio Grande Bridge
No. 1831
NM 51 at Elephant Butte State Park
Sierra County

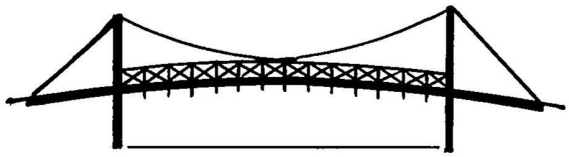
This bridge is located on NM 51 at the entrance of Elephant Butte State Park. It is a timber trestle bridge consisting of ten 25-foot

spans and measures 250 feet along its centerline. This bridge is unusual for a timber bridge since it was constructed on a curve in the highway. The piers are offset from a straight line and the deck is superelevated to compensate for the curve.

This bridge was completed in 1940 by W. E. Bondurant. The bridge is attractively located in the canyon below Elephant Butte Dam and is presently used for access to the dam and state park.

Cuchillo Negro Creek Bridge
No. 1832
NM 51 near Truth or Consequences
Sierra County

The Cuchillo Negro Creek Bridge was also built in 1940 by W. E. Bondurant. Although it was not built on a curve, it is similar in materials and construction to that of the bridge at Elephant Butte State Park. The Cuchillo Bridge includes twelve timber spans at 25 feet each and is supported by timber piers and abutments. The roadway was later widened to 25 feet and a four-foot sidewalk was added to the north side. This bridge is located near the confluence of Cuchillo Negro Creek and the Rio Grande and it is a good example of the standard timber trestle bridge construction which was used extensively by the Highway Department.



Suspension

Suspension bridges, generally associated with great engineering projects such as the Brooklyn Bridge and Golden Gate Bridge, were utilized on a much smaller scale in New Mexico. The first suspension bridges in the state were constructed as county projects. J. S. Thurston and Sons built a 232-foot long suspension bridge over the Animas River at Aztec in 1908. This bridge is said to have been the only bridge in the county over the Animas and San Juan Rivers to survive the disasterous flood of 1911. The Thurstons reportedly built other suspension bridges in San Juan County. Suspension bridges were also built in Chavez County during the early 1900s over the Pecos River near Hagerman and near Lake Arthur. The Hagerman Bridge failed in 1920 due to a herd of stampeding steers and the Lake Arthur Bridge collapsed in 1956 due to an overloaded cattle truck. (Figures 21 & 22)

The New Mexico State Highway Department became interested in suspension bridges during the 1920s since these bridges could span relatively long crossings and the towers could be set back away from the bank where they would not be washed out. The Highway Department completed two suspension bridges in 1924, one over the Chama River at Abiquiu and the other over the Rio Grande at Otowi. The Otowi Suspension Bridge is now the only remaining example of an "engineered" suspension bridge in the state.

Otowi Suspension Bridge*
No. 369
NM 4 at Otowi
Santa Fe County

The Otowi Suspension Bridge was completed over the Rio Grande in 1924. The bridge has a 174-foot span and 10-foot wide timber roadway. A concrete tower was erected at each end to support the cables. Timber stiffening trusses were installed along each side of the roadway representing a major engineering improvement over other suspension bridges constructed in New Mexico.

The Otowi Suspension Bridge was built just upstream from an existing railroad bridge which was used by vehicular traffic when trains were not in sight prior to the construction of the suspension bridge. The new suspension bridge provided improved access to the Los Alamos Ranch School and was used to move lumber, sheep and cattle across the Rio Grande. The bridge was also used to carry equipment and materials to government facilities for developing the atomic bomb at Los Alamos. The site of the diner operated by Edith Warner and visited by Robert Oppenheimer, Niels Bohr and other scientists during the early days of atomic research at Los Alamos is located on the west side of the Rio Grande at the bridge.

The Otowi Suspension Bridge was designed by the New Mexico State Highway Department under the supervision of State Highway Engineer James A. French. Construction was supervised by Lee W. Campbell and the Kansas City Structural Steel Company is known to have supplied at least part of the required materials. The Otowi Bridge was a major engineering achievement for the State Highway Department for the 1920s and it was featured on the cover of the September, 1924, issue of

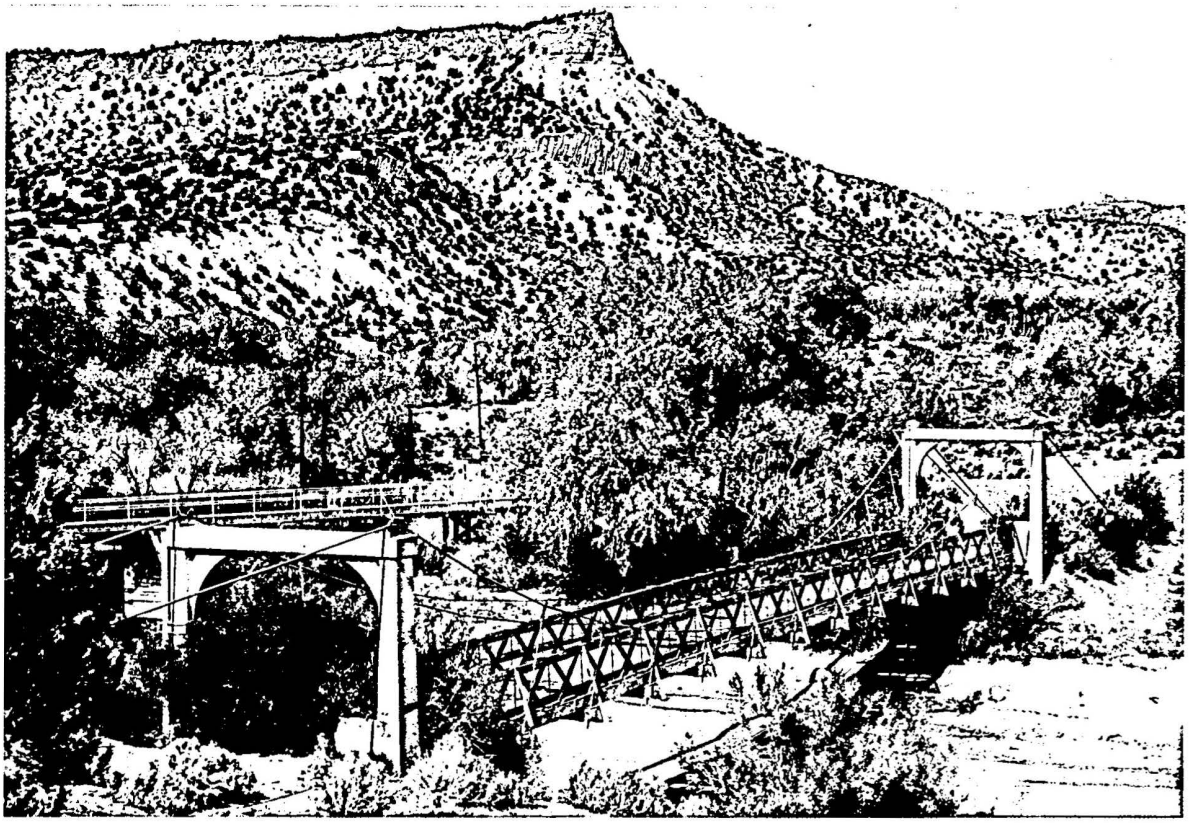


Fig. 61. **Otowi Suspension Bridge** (No. 369)

the *New Mexico Highway Journal.*

The suspension bridge was by-passed in 1948 when a new steel truss bridge was completed near the site. The suspension bridge was left in place as a convenient crossing for livestock but it is now unsafe due to the deteriorated condition of its deck. The Otowi Suspension Bridge is the only remaining example of an "engineered" suspension bridge in New Mexico. The site of the bridge and Edith Warner's diner and residence have been included on the National Register of Historic Places. (Figure 61)

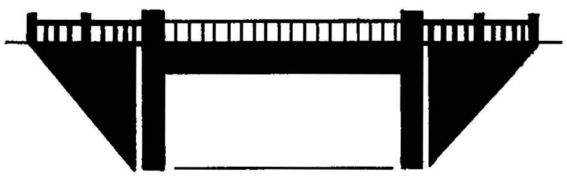
Glen-Woody Suspension Bridge

No. S-20
Private Road near Pilar
Taos County

In the late 1890s, W. M. Woody discovered a large body of low-grade gold ore on the east bank of the Rio Grande between Taos and Santa Fe. Woody succeeded in obtaining financing for construction of a 50-ton mill and mining camp. A bridge was constructed over the Rio Grande at the mill which became known as the Glen-Woody Bridge.

The existing Glen-Woody Bridge is undoubtedly a successor of earlier bridges at the site. This bridge is a "swinging" suspension bridge with timber towers and a timber deck. It has been repaired a number of times in recent years because of damage due to flood waters which have ripped timbers from its deck.

The length of the Glen-Woody bridge is 155 feet and it has a 10-foot roadway. It is privately owned and maintained and provides access to several homes located on the west bank of the Rio Grande.



Railroad Underpass

Elimination of railroad grade crossings was a priority of the Highway Department during the 1920s and 1930s for both convenience and highway safety. Grade crossings were eliminated by construction of overpasses or by excavating and building underpasses. Early underpasses were often built at a point of fill

on the railroad grade in order to eliminate as much excavation as possible. Railroad tracks were raised at many underpass sites in order to provide improved approach grades for vehicular traffic. Many underpasses in New Mexico were built as cooperative projects where the cost was shared between the railroad and the Highway Department.

The following eight examples represent the types of early underpass structures which were built in New Mexico during the 1920s and 1930s and which remain in use at this time.

Central Avenue Underpass
No. 3116
Central Avenue, Albuquerque
Bernalillo County

The Central Avenue Underpass was constructed in 1937 in order to eliminate a railroad grade crossing on US 66, the main east-west route through Albuquerque. The underpass was designed by the State Highway Department and constructed by F. D. Shufflebarger. The railroad grade was raised seven feet by the Santa Fe Railway in order to allow reasonable approach grades for the underpass. Steel beams and concrete piers and abutments were used to support the railroad deck which has a total length of about 68 feet. The underpass included four traffic lanes and a pedestrian walkway on each side, and represented a large municipal project for its day.

The Central Avenue Underpass adjoins the site of the Alvarado Hotel which was known for its well-kept gardens and California Mission Style architecture. The underpass was remodeled during recent years and few details remain of its original 1930s construction. (Figure 26)

Tijeras Avenue Underpass
No. 6089
Tijeras Avenue, Albuquerque
Bernalillo County

The Tijeras Avenue Underpass is located two blocks north of the Central Avenue Underpass and was built in 1937 by the same contractor, D. F. Shufflebarger. The Tijeras Avenue Underpass is constructed of steel beams and concrete piers and abutments similar to design of the Central Avenue Underpass. The railroad deck above the underpass has a total length of about 40 feet. The underpass includes two traffic lanes and a walkway on each side.

Although the Tijeras Avenue Underpass is a smaller structure than the Central Avenue Underpass, few alterations have been made to it since its construction. It remains as a good example of the municipal public works style of the 1930s.

North 1st Street Underpass
No. 5445
North 1st Street, Raton
Colfax County

This underpass is a steel beam structure with a concrete deck and abutments. It includes two parallel spans, one providing for two tracks owned by the Santa Fe Railway and the other for vehicular traffic. Each span is about 50 feet in length. Highway Department records indicate that the underpass was completed in 1947.

The North 1st Street Underpass is an impressive municipal structure with decorative concrete columns along each portal and with attractive sidewalks and guardrails along its west abutment wall. The site of the underpass adjoins a city park and the style is consistent with the downtown area of the city. The North 1st Street Underpass is a good example of the public works architectural and engineering style of the 1930s and 1940s prior to the widespread use of pre-cast concrete and large steel beam construction. (Figure 62)

South 2nd Street Underpass
No. 5492
South 2nd Street, Raton
Colfax County

This underpass is composed of two 40-foot steel beam spans supported by a central concrete pier and a concrete abutment at each end. The first span was completed in 1934 for a two lane underpass. The second span was added in 1955 to allow for two additional traffic lanes.

The South 2nd Street Underpass was constructed to eliminate the grade crossing at the Santa Fe Railway south of the city. The original span was completed as a Federal-Aid Project during the depression era for relief of unemployment and improved public safety.

Texico Underpass
No. S-115
County Road A-34 near Texico
Curry County

The Texico Underpass is an example of a

grade separation where concrete abutments were constructed and an underpass was excavated at a point of fill on the railroad. This underpass includes two steel girder spans, each carrying a set of railroad tracks. The first span was completed in 1924.

In 1942, the abutments were extended and the second span was added. Each span is approximately 24 feet in length. Information from the *New Mexico Highway Journal* indicates that the original abutments and roadway were constructed as a Federal-Aid Project and the steel span was provided by the Santa Fe Railway.

Algodones Underpass
No. 2542
US 85 near Algodones
Sandoval County

The Algodones Underpass was also constructed at a point of fill on the railway. Concrete abutments were installed on each side of the roadway and a 50- foot steel girder span was used for the railroad crossing. The underpass was completed in 1928, probably as a joint project between the Highway Department and the Santa Fe Railway. It replaced an earlier masonry drainage structure which was used as an underpass during dry weather. This structure is located about 300 feet north of the 1928 underpass.

Fort Sumner Underpass
No. 2266
US 85 at Fort Sumner
De Baca County

The Fort Sumner Underpass was completed in 1938 and is representative of the massive concrete public works style common for grade separation structures built during the 1930s and 1940s.

This underpass is a steel beam structure with a concrete deck and abutments. The length of the railroad deck is approximately 48 feet and it spans two traffic lanes and two sidewalks at an angle of 45 degrees. The underpass includes decorative concrete columns and guardrails. The site of the underpass is located near the Santa Fe Railway Station at Fort Sumner which was constructed in the distinctive mission style used by the railway.

The Fort Sumner Underpass is located on US 85 immediately north of the business district. It was a major highway structure upon its completion in 1938.

Fig. 62. **North 1st Street Underpass, Raton** (No. 5445)

San Marcial Underpass*

No. 2594
NM 1 near San Marcial
Socorro County

The underpass near San Marcial is located at a point of fill on the railroad grade requiring no special drainage features. The railroad bridge includes a 48-foot steel girder span and a 28-foot timber approach span at each end. The spans are supported by heavy bridge timbers set on concrete footings.

Highway Department records indicated that this underpass was completed in 1939 by the Santa Fe Railway. According to the nameplate, the steel girder span was fabricated by the Lassig Bridge and Iron Works of Chicago in 1894, making it one of the oldest bridge structures in New Mexico. This underpass is presently in use on NM 1.

EVALUATION OF HISTORIC BRIDGES

Development of the Historic Bridge Survey

The Historic Bridge Survey (HBS) was initiated by the New Mexico State Highway and Transportation Department (SHD) in consultation with the State Historic Preservation Officer (SHPO) to provide an inventory of historic bridges in New Mexico and to provide a management tool for determining relative engineering and historical significance among early bridges. Information about early bridges was gathered to serve as a basis for determining eligibility for the National Register of Historic Places (NRHP) in accordance with the National Historic Preservation Act of 1966 and for meeting other federal and state requirements which are applicable to historic bridges affected by a proposed undertaking.

The HBS was completed in three phases. Phase I included an initial screening of early bridges and development of criteria for bridge evaluation. Phase II included field investigations and evaluation of bridges to determine relative importance. Phase III included additional research on selected bridges and preparation of this final report. The following is a description of specific work completed in each phase of the HBS.

Phase I - *Initial Screening and Development of Criteria for Evaluation*

1. An initial screening and review of about 750 bridges was completed by use of the SHD's bridge inspection inventory. The inventory includes all state, county and municipal bridges presently being inspected by the SHD. The Department maintains a file on each bridge in its inventory complete with photos, inspection reports and other information. The file for each bridge built in New Mexico before 1945 was reviewed for the survey. In addition, about 500 inactive files concerning demolished and abandoned bridges were reviewed. An initial screening was also completed on some 200 bridge files maintained by the Center for History of Engineering and Technology at Texas Tech University.

2. Articles and publications concerning early bridges in New Mexico were reviewed and a reference list prepared. Primary sources of information included the *Reports of the State Engineer and State Highway Engineer* (1912-1923, 1933-1958), the *New Mexico Highway Journal* (1923-1931), and *New Mexico* (1931-1960). Information concerning early bridges was obtained from the SHD Library, the New Mexico State Library, the State Records Center and Archives, Museum of New Mexico, the Center for the History of Engineering and Technology and from other sources.

3. An inventory of early bridges was developed and bridges were selected for the purpose of planning field investigations. Bridges selected for field investigations included all truss bridges, all concrete and masonry arch bridges, and all bridges of special design. The best examples of steel, concrete and timber beam bridges which were built using SHD standard designs were also selected for field checking. When the initial screening indicated that a standard design beam bridge was relatively short in length and was built during the 1930s and 1940s, no field check was planned unless the bridge file photographs indicated a special engineering or historical feature.

4. A historical overview of road and bridge construction in New Mexico was prepared under Phase I work. This overview was based on the information obtained during the literature search and initial screening of early bridges. The overview includes sections on road and bridge development in New Mexico from the prehistoric period to modern times.

5. Selection criteria and a numerical rating system were developed for indicating relative historical and engineering significance among early bridges. The criteria used for evaluating early bridges in New Mexico were based upon the criteria of the NRHP and other criteria established for determining significance of historic structures. The numerical rating system was prepared in view of New Mexico's relatively late bridge development and limited number of bridge types. A summary of the rating system is included in a following section of this report.

Phase II - *Field Investigations and Evaluation of Bridges*

1. Field investigations and recording of over 100 early bridges were completed during Phase II work. Field investigations included site descriptions, measurements, photographs, interviews and other documentation. Emphasis during field investigations was placed on integrity and originality of the design, materials, workmanship, location and setting.

2. Bridges were evaluated in accordance with the numerical rating system developed during Phase I. A list of the rated bridges by bridge type was prepared for determining relative significance among early bridges.

3. Documentation was completed and a file was prepared on each bridge recorded in the field. Each file includes a data sheet, location map, rating sheet, photographs and field notes. Other information such as articles, interviews and SHD data were included when available.

4. A slide presentation concerning historic bridges and bridge development in New Mexico was prepared. Slides of early photographs of bridge construction and slides made during recent field investigations are included in the presentation.

Phase III - *Final Report*

1. The best examples of particular bridge types in New Mexico were selected and additional research was conducted on these bridges.

2. The final report was prepared consisting of an updated overview of road and bridge construction in New Mexico, descriptions of recorded bridges, a summary of the evaluation work completed, a management plan for bridge preservation and a listing of selected bridges.

3. Copies of the final report and individual bridge files developed under Phase II were submitted to the SHPO.

Inventory System

The inventory system now includes over 100 bridge files which are maintained by the Environmental Section of the SHD to provide information concerning engineering and historical significance of individual bridges. Each file includes a data sheet, location map, rating sheet, photographs, field notes and other information helpful in determining engineering and historical significance.

The inventory will be updated by the Environmental Section on a periodic basis and new information will be added to existing files when available. New bridges will be added to the inventory when they are found by the Environmental Section to merit historical consideration.

Bridge Rating System

The numerical rating system for determining relative significance among bridges was specifically designed for evaluating early New Mexico bridges. The rating system was developed in consultation with the SHPO from a knowledge of early bridges in the state obtained after the initial screening and research. The system was adjusted and refined upon completion of the field investigations and recording of early bridges. It was designed to serve as an indicator of engineering and historical significance only and it should not be used exclusively for determining eligibility for the NRHP.

The numerical rating system was selected over a narrative criteria or intuitive method of determining significance in order to provide a quantitative approach to the bridge selection process. The numerical rating system developed for New Mexico is based upon NRHP criteria for determining eligibility and, to a lesser extent, upon the general standards of the Historic American Engineering Record and the American Society of Civil Engineers for designation of historic sites.

The numerical rating systems utilized by other states were also reviewed during the development of the rating system for New Mexico. Because of the wide range of bridge types and development periods, systems of other states could not be applied directly to New Mexico but were considered in the selection of the rating factors.

The rating system developed for the HBS includes factors relating to the physical characteristics of the bridge and to the rarity of the bridge type in New Mexico (factors 1 through 9). In most cases, factors 1 through 9 are easily quantified. The rating system also includes factors relating directly to historical importance and integrity of its design, materials, workmanship, location and setting (factors 10 through 13). These factors are specified in the general criteria of the NRHP and are subjective in nature.

No factors relating to the load carrying capacity or safety of the bridge or to its potential for preservation were included in the rating system since these factors have no relation to the criteria of the NRHP. If the bridge is found eligible for listing, the condition and safety of the bridge and its suitability for preservation will be weighed prior to any undertaking to determine if the bridge should be preserved.

The numerical rating system for historic bridges in New Mexico is designed as an indicator of engineering and historical significance. It was developed to allow comparisons of similar bridges to be made during the evaluation process and it should not be used exclusively for determining eligibility for the NRHP.

The following is a summary of the factors used for the numerical rating system:

1. **Date Completed**
   (20 Points Max.)

Pre-1912	20
1912-1930	16
1931-1940	12
1941-1945	8
After 1945	2

The age of the bridge was selected as an important factor for awarding points. The older the bridge, the more significant it was considered. Twenty points were awarded for bridges constructed prior to New Mexico Statehood in 1912. Most of the bridges remaining from this period were built as county or municipal projects. Sixteen points were awarded for bridges constructed from 1912 to 1930 during the early days of the SHD. Many large bridge structures were built as federal and state projects during this period. The depression years of the 1930s brought hard times to New Mexico but also brought large infusions of federal funds for road and bridge construction. Twelve points were awarded for bridges constructed during the depression years from 1931 to 1940. After the outbreak of war in Europe, the federal government emphasized construction of defense highways while deferring non-critical road projects. Eight points were awarded for bridges constructed during the war years from 1941 to 1945. After 1945, a new period of road and bridge building began in New Mexico, especially with the introduction of the Interstate System in 1956. Two points were awarded for bridges built after 1945.

2. **Type of Bridge**
   (6 Points Max.)

Truss, Suspension or Arch	6
Multi-Span Beam	4
Single-Span Beam or Slab	2

Preference was given to unique bridge types such as truss, suspension and arch bridges since these bridge types are becoming increasingly rare in New Mexico and are of special interest to historians and engineers researching bridge development. Six points were awarded to truss, suspension and arch bridges. Simple beam bridges are common in New Mexico and points were reduced for these structures.

3. **Length of Bridge**
   (6 Points Max.)

200 Feet or Over	6
100 to 199 Feet	4
50 to 99 Feet	2
49 Feet or Less	0

Due to the nature of the terrain and large variations in runoff, early bridges in New Mexico often included a main span and a number of smaller approach spans. The overall length of a bridge structure was considered an important factor in awarding points for major engineering projects. A review of early bridges in New Mexico indicated that a natural break exists between the larger and the smaller bridge projects at a length of about 200 feet. A total of six points were awarded for bridges over 200 feet in length. Shorter bridges were awarded four points or less.

4. **Length of Longest Span**
   (6 Points Max.)

200 Feet or Over	6
100 to 199 Feet	4
50 to 99 Feet	2
49 Feet or Less	0

Points were awarded not only on the basis of total bridge length, but for the length of the longest span. By awarding points for the longest span, preference was given to bridges which included a large main span or single large span of particular engineering achieve-

ment. Six points were awarded for a bridge span over 200 feet in length. Shorter spans were awarded four points or less.

5. **Design Engineer, Bridge Fabrication Company, Bridge Builder or Others Known to be Associated With Construction of Bridge**
(8 Points Max.)

Design Engineer Known	4
Fabrication Company Known	4
Bridge Builder Known	4
Others Known	4

Points were awarded to an early bridge if the names of the design engineer, bridge fabrication company, bridge builder or others associated with its construction are known. Persons or companies known to be involved with a particular bridge are important in determining the historical and engineering significance of the bridge. No distinction was made in the rating system between well known or lesser known persons or bridge companies. A maximum of eight points were awarded under this rating factor in order to limit the advantage of more recently constructed bridges.

6. **Rarity of Bridge Design in New Mexico. Pratt Truss, Warren Truss, Concrete Arch, Timber Beam, Etc.**
(8 Points Max.)

Unique, One of a Kind	8
Rare	6
Unusual	4
Common	2

Rarity of a particular bridge design was used in the rating system to give preference to unique and unusual bridges over bridges which were built from standard designs and plans. If a bridge was an example of a unique bridge design and was one of a kind, it was awarded eight points. If a bridge was of a design rarely used in New Mexico and known to have been used at perhaps two or three locations, it was awarded six points. Four points were awarded to a bridge if it was of an unusual design and known to have been used at four or five locations. And, finally, a bridge which was fairly common and known to have been used at six or more locations was awarded two points.

7. **Number Surviving in New Mexico. Pratt Truss, Warren Truss, Concrete Arch, Timber Beam, Etc.**
(8 Points Max.)

Sole Survivor	8
Two or Three	6
Four or Five	4
Six or Over	2

The number of surviving bridges in each bridge type was considered an important factor for rating early bridges. The sole survivor of a particular bridge type was awarded eight points. If a bridge was one of two or three remaining in New Mexico, it was awarded six points. If four or five remained, it was awarded four points. A bridge similar in type to six or more bridges was awarded two points.

8. **Oldest and Longest Surviving in New Mexico**
(8 Points Max.)

Oldest Known Example	4
Longest Known Example	4

The oldest surviving example of each bridge type is usually noteworthy from a historical point of view. Likewise, the longest surviving example of each bridge type is often noteworthy from an engineering point of view. Additional points were awarded to the oldest and longest examples of each bridge type in order to give preference to these bridges.

9. **Special Features**
(8 Points Max.)

Special Design Feature	4
Special Decorative Feature	4

Preference was given to bridges which have special design or decorative features. Four points were awarded to bridges for special features such as distinctive structural elements or special abutments or piers. Four points were awarded to bridges with special decorative features such as decorative guardrails or lattice work, unusual nameplates or other special details.

10. **Historical Importance Due to Its Economic, Technological, Political or Social Impact**
(8 Points Max.)

National Importance	8
State-Wide Importance	6
Regional Importance	4
Local Importance	2
None	0

Historical importance of a bridge can originate from a number of different sources. A bridge may have been influential in the development of a town or region. It may have been associated with persons or events significant in our past or dedicated as a monument to a particular person or event. A bridge may be of historical importance because it represented an advancement in bridge building technology and had a significant impact on future bridge design. It also may be noteworthy because of

the reputation of its designer or builder.

Historical importance is difficult to quantify and depends to a great extent upon the opinion of the person or group rating the bridge. For the purpose of this rating system, historical importance was based upon the national, state, regional or local importance of the bridge. A bridge which exhibited national importance due to its economic, technological, political or social impact or reputation was awarded eight points. A bridge which exhibited a state-wide importance was awarded six points. A lesser number of points were awarded to bridges with regional or local importance.

11. Integrity of Design, Materials and Workmanship
(6 Points Max.)

Original Design Elements Unaltered	2
Materials Consistent With Original	2
Elements of Original Workmanship Present	2

This rating factor relates to how well the bridge retains the original features of its bridge type. Preference was given to bridges where the original design elements were unaltered and the addition of improvements over the years was limited. If original elements were repaired or replaced, preference was given to bridges where the replacement materials were consistent or compatible with the original work. Preference was also given to bridges where original workmanship and details were preserved. A maximum of six points were included under this rating factor.

12. Integrity of Location and Setting
(6 Points Max.)

Bridge Located at Original Site	2
Little or No Change in Setting	2
Bridge Located in or near Historic District	2

Preference was given to bridges which retain their original location and setting. For many bridges such as stone or concrete bridges, removal to other sites is not practical. However, early truss bridges were often fabricated to be easily dismantled and removed to new sites when a crossing was to be improved. Two points were awarded to a bridge which is located at its original site. Two points were also awarded to a bridge where little or no change in the immediate surroundings has taken place since the bridge was constructed or moved to the site. A bridge located in or near a Historic District was awarded two additional points because of this designation for preservation of the setting.

13. Feeling and Association With the Past
(10 Points Max.)

Excellent	10
Good	8
Fair	6
Fair to Poor	4
Poor	2

The purpose of this rating factor is to provide additional preference to a bridge which communicates a sense of what it was like during its historic period. The overall originality and integrity of the design, materials, workmanship, location and setting of a bridge were considered in determining the degree of the feeling and association with the past which it communicates. The maximum number of points awarded under this rating factor is ten.

The maximum number of points which a bridge can be awarded under the rating system is 108. Most of the truss bridges in the state rated in the upper one-third of the recorded bridges. Masonry and concrete arch bridges and bridges of special design also rated high. Standard design beam bridges generally rated lower. A summary of the ratings for the recorded bridges is included in Appendix C.

PRESERVATION OF HISTORIC BRIDGES

Recommended Management Plan

The purpose of the management plan is to provide guidance to the SHD for completing federal and state historical review requirements when an early bridge in New Mexico may be affected by a proposed undertaking. Information contained in the HBS including the final report and individual bridge files will allow the reviewing agencies to make a determination if a bridge is eligible for the NRHP. If it is eligible for or already listed on the NRHP, preservation of the bridge or steps to mitigate the effect of the undertaking can be initiated. The following is a summary of the recommended management plan for historic bridges.

1. The SHD and/or Federal Highway Administration (FHWA) will submit a description of a proposed undertaking affecting any early SHD bridge to the SHPO for review and comment. Submissions will be made on a case by case basis as repairs or replacements are required.

2. Each description of a proposed undertaking will include an evaluation of the engineering and historical significance of the bridge which may be affected. Evaluations will be based upon information from the HBS including the final report and individual bridge files, upon the numerical rating system developed for early bridges and upon a comparison with other surviving bridges of a similar type. The SHD and/or FHWA will provide a recommendation to the SHPO concerning the bridge's potential eligibility for the NRHP.

3. If a proposed undertaking will affect a bridge determined to be eligible for or listed on the NRHP, the SHD and/or FHWA will prepare a preservation/mitigation plan and submit it to a SHPO for review and comment. The plan will include alternatives for preservation of the bridge or mitigation of the effect of the proposed undertaking. The agreed upon plan to preserve the bridge or mitigate the effect will be implemented by the SHD and/or FHWA.

4. The HBS includes all truss bridges, masonry and concrete arch bridges and other early bridges of special design which are known to exist in the state. If one of these bridges owned by the SHD was inadvertently left out of the HBS, the SHD will record and include it in the survey prior to a proposed undertaking. The historical review process will then proceed in the same manner described above.

5. The SHD built many standard design steel, concrete and timber beam bridges during the 1930s and in more recent years. These bridges were evaluated and a number of examples were included in the HBS in order to document their role in the bridge development of the state. Descriptions of proposed undertakings affecting standard design beam bridges already included in the HBS will be submitted to the SHPO for review based upon the individual bridge files. Descriptions of proposed undertakings affecting standard design beam bridges not included in the HBS will also be submitted to the SHPO for review based upon the background information and examples included in the HBS.

6. The SHD will update the HBS as required to include new information on early bridges already recorded and to include additional bridges in the survey which are found to be noteworthy and merit further review.

Recommended Mitigation Alternatives

The criteria used in the HBS for the evaluation of early bridges do not include any judgment concerning load carrying capacity, safety of a bridge or its potential for preservation. If a bridge is determined to be eligible for the NRHP and a proposed undertaking is found to affect the structure, alternatives for mitigation must be considered. The following mitigation alternatives are included for bridges in New Mexico determined to be eligible for the NRHP. The most desirable alternatives are listed first.

1. Repair or renovate the historic bridge in a manner which retains its original elements and use.

2. Repair or renovate the historic bridge for one-way traffic and construct a new parallel bridge.

3. Construct a new bridge on a new alignment and preserve the historic bridge at its original site for an alternate use. It is often desirable to provide a parking area or rest stop at the site and to include a historical interpretation of the bridge.

4. Remove the historic bridge and reuse it at a new site for light traffic, bicycle or pedestrian use.

5. Record and document the historic bridge in accordance with the standards of the Historic American Engineering Record. Dismantle and store the bridge at a protected location for future re-use at a compatible site.

6. Record and document the historic bridge in accordance with the standards of the Historic American Engineering Record. Dismantle and remove the bridge from the site. Nameplates, decorative elements and other notable features should be salvaged. Dispose of remaining bridge members and elements.

Selected Bridges

The following 40 bridges were selected for their exceptional historical and engineering qualities and their potential eligibility for the NRHP. These bridges may be used as the basis for a thematic group nomination to the NRHP.

Pratt Through Truss, Pinned Connections

Rio Hondo Bridge
No. 3452
County Road A-4 at Picacho
Lincoln County

This bridge was one of three spans originally built in 1902 over the Pecos River, east of Roswell. It has a total length of 133 feet and is the longest Pratt truss span with pinned connections remaining in New Mexico. It is also the oldest documented steel truss bridge in the state.

Cold Spring Canyon Bridge
No. 1894
County Road B-13
near San Lorenzo
Grant County

Built in 1908 by the El Paso Bridge and Iron Company, this bridge is one of the earliest Pratt through truss bridges remaining in New Mexico. It is built of light weight members with pinned connections and spans a small rock canyon.

Gallinas River Bridge
No. 5307
NM 65 near Montezuma
San Miguel County

The Gallinas River Bridge was originally constructed in 1919 as a railroad bridge on the Hot Springs branch line. Since removal of the tracks, the bridge and part of the old railroad grade have been used as a state road. This bridge adjoins the Montezuma Historic District and has been by-passed and preserved in place by the SHD.

Animas River Bridge
No. 8120
County Road A-136 at Cedar Hill
San Juan County

This bridge is located near the site where A. U. Graves operated a horse-drawn ferry and later constructed a toll bridge across the Animas River. It is believed to have been built in 1912 but this date has not been confirmed. It is one of the few remaining Pratt truss bridges with pinned connections remaining in New Mexico.

Pratt Through Truss, Rigid Connections

Rio Felix Bridge
No. 357
NM 2 near Hagerman
Chavez County

Completed in 1926, the Rio Felix Bridge was a major highway structure on the road between Roswell and Carlsbad. In 1984, the Rio Felix was by-passed by a new bridge and preserved in place by the SHD. It is the longest Pratt truss bridge with rigid connections remaining in New Mexico and it has been listed on the State Register of Cultural Properties.

John Dunn Bridge
No. 5243
County Road B-7
near Arroyo Hondo
Taos County

This bridge is located at the site of John Dunn's original toll bridge across the Rio Grande, north of Taos. It was moved to this site in 1951 and is a good example of the 101-foot long through truss bridges which were built in New Mexico during the late 1920s and early 1930s.

Rio Grande Bridge
No. 5826
NM 96 at Rio Grande
Gorge State Park
Taos County

This bridge is located at the crossing over the Rio Grande on the old wagon road between Taos and the railhead at Taos Junction. It was moved to the site in 1957 and is a good example of the 101-foot long through truss bridges which were built in New Mexico during the late 1920s and early 1930s.

Mimbres River Bridge
No. 1332
NM 90 at San Lorenzo
Grant County

Completed in 1927, this bridge was an important link on the Black Range Road between Silver City and Hillsboro. It is also a good example of the 101-foot long Pratt through truss bridges which were built in New Mexico during the late 1920s and early 1930s.

Parker Through Truss

San Juan River Bridge
No. 1792
US 666 at Shiprock
San Juan County

Completion of the San Juan River Bridge at Shiprock in 1937 represents the high point of steel truss bridge construction in New Mexico. It is composed of six 167-foot Parker through truss spans and has a total length of 1007 feet. It is the longest steel truss bridge remaining in New Mexico and has been listed on the State Register of Cultural Properties.

San Francisco River Bridge
No. 599
US 180 near Alma
Catron County

This bridge was constructed in 1926 under the direction of the U.S. Forest Service to provide access to public lands in a remote section of southwestern New Mexico. It is one of the oldest Parker through truss bridges in the state. The San Francisco River Bridge has recently been by-passed and preserved in place by the SHD.

Rio Puerco Bridge
No. 531
NM 116 near Bernardo
Socorro County

After a huge flood destroyed part of the newly completed timber trestle across the Rio Puerco at Bernardo in 1929, the bridge was repaired by the addition of two through truss spans of 142 feet each. The Rio Puerco Bridge has been by-passed and now carries only light traffic. This bridge is a good example of truss construction combined with other spans to provide a major bridge structure.

Animas River Bridge
No. 119
NM 550 at Aztec
San Juan County

This bridge was built in 1929 by the Pueblo Bridge and Construction Company of Pueblo, Colorado, and was a major highway structure in the state upon its completion. The Animas River Bridge is unique in that it includes both a 200-foot through truss and two 75-foot pony truss approach spans in its design.

Rio Hondo Bridge
No. 5272
NM 395 near Tinnie
Lincoln County

This bridge was originally constructed in 1927 at Bull Canyon in Quay County. In 1952, it was moved and erected over the Rio Hondo near Tinnie. It is a good example of the 142-foot long Parker through truss design and is listed on the State Register of Cultural Properties.

Pecos River Bridge
No. 1001
Private Road near San Jose
San Miguel County

The Missouri Valley Bridge and Iron Company completed this bridge in 1921 on the main road between Las Vegas and Santa Fe near the route of the Santa Fe Trail. It has a 106-foot length and is a very early Parker through truss for New Mexico. The bridge has been abandoned and the site returned to a private land owner.

Warren Through Truss

Gila River Bridge
No. 1382
County Road 50 near Cliff
Grant County

One of the earliest bridge projects funded under the State Highway Commission was the Gila River Bridge completed in 1915. It served as an important part of the early state highway system connecting the mountainous Gila region with Silver City and southern parts of the state. The Gila River Bridge is the oldest Warren through truss remaining in New Mexico.

Largo Canyon Bridge
No. 8118
County Road A-80 near Blanco
San Juan County

This bridge was originally constructed in 1928 over the San Juan River at Blanco. In 1966, it was relocated about five miles east over Largo Arroyo on a county road. The Largo Canyon Bridge is one of the longest truss spans constructed in New Mexico.

Warren Pony Truss

Mora River Bridge
No. 4984
NM 97 near Shoemaker
Mora County

This bridge was originally located over the Sapello River at Watrous, New Mexico. In 1934, three pony truss spans were moved east about eight miles to their present location. The Mora River Bridge was reportedly fabricated by the Missouri Valley Bridge and Iron Company of Leavenworth, Kansas, and is a good example of steel pony truss bridges which were once common on county and secondary roads in New Mexico.

Kearny's Gap Bridge
No. 5507
NM 283 near Las Vegas
San Miguel County

Kearny's Gap Bridge was named for the opening in the range of hills southwest of Las Vegas which was used by Stephen W. Kearny and his Army of the West in August, 1846, on their march to Santa Fe. It was completed in 1914 from plans approved by State Engineer James French.

Starkweather Canyon Bridge
No. 2208
NM 12 near Reserve
Catron County

This bridge was constructed in 1939 as a Forest Service project and has a single pony truss span of 100 feet. it is a good example of the Warren pony truss design with the added feature of a superelevated deck.

Parker Pony Truss

Rio Grande Bridge
No. 1578
NM 74 at San Juan Pueblo
Rio Arriba County

This bridge was constructed in 1925 under the direction of the Office of Indian Affairs to provide access to farming lands located across the Rio Grande, west of San Juan Pueblo. It includes four Parker pony truss spans of 100 feet each and it is the longest pony truss bridge remaining in New Mexico. It adjoins San Gabriel, the first capitol of New Mexico, which has been designated as a National Historic Landmark.

Gallinas River Bridge
No. 900
County Road A-11 at Montezuma
San Miguel County

Plans for the steel pony truss bridge at Montezuma are dated March, 1911, and the bridge was probably constructed shortly thereafter as a county project. This bridge adjoins

the Montezuma Historic District and it is among the oldest steel pony truss bridges remaining in New Mexico.

Rio San Jose Bridge
No. 1778
I-40 Frontage Road near McCartys
Cibola County

The Rio San Jose Bridge was completed in 1936 on the edge of the malpais area near McCartys. It has a 100-foot length and is a good example of the Parker pony truss design popular in New Mexico during the 1930s.

Steel Deck Truss

Rio Grande Gorge Bridge
No. 6462
US 64 near Taos
Taos County

The Rio Grande Gorge Bridge is a continuous steel deck truss completed in 1965. The gorge is 1200 feet wide and 600 feet deep at this location. The bridge was designed by the SHD Bridge Design Section and it won first place in 1966 for the most beautiful span in competition sponsored by the American Institute of Steel Construction. Although this bridge does not meet the age requirement of 50 years for NRHP eligibility, it is included as an exception because of its engineering significance and beauty.

Percha Creek Bridge
No. 1519
NM 90 near Hillsboro
Sierra County

This bridge is a Warren truss built in 1927 as part of a new road connecting the mining districts of Hillsboro and Silver City. The Percha Creek Bridge is a good example of steel deck truss construction in New Mexico which was limited to sites where adequate clearance for the truss was available under the roadway.

San Francisco River Bridge
No. 2211
US 180 near Luna
Catron County

This bridge was designed by the Bureau of Public Roads and constructed in 1934 as a Forest Service project. It is a good example of early deck truss construction in New Mexico.

Steel Arch

Los Alamos Canyon Bridge
No. 7622
NM 4 at Los Alamos
Los Alamos County

One of the largest and most impressive bridge structures in the state is the steel arch bridge over the Los Alamos Canyon completed in 1951. This bridge is 820 feet in length and, at its center point, is 180 feet above the canyon floor. It connects Los Alamos National Laboratory technical areas with the residences and businesses located at Los Alamos townsite. It also does not meet the age requirement for NRHP eligibility, but it is included as an exception because of its association with the early days of atomic research at Los Alamos, and because of its engineering significance.

Steel Beam

Galisteo River Bridge
No. 166
County Road 33 at Galisteo
Santa Fe County

The Galisteo River Bridge is a steel I-beam bridge with five spans of 40 feet each. The steel I-beams were fabricated by the American Bridge Company and the bridge was completed in 1927 by James Harvey. The site of the bridge adjoins the old settlement of Galisteo which has been designated a Historic District.

Masonry and Concrete Arches

Gallinas River Bridge
No. 1549
NM 65 at Las Vegas
San Miguel County

This bridge was completed in 1909 by the Missouri Valley Bridge and Iron Company of Leavenworth, Kansas, at a cost of $32,000. It is known for its attractive arch design and decorative concrete railings. It is the primary feature of the Bridge Street Historic District and it is also the longest concrete arch bridge remaining in New Mexico.

Hot Springs Boulevard Culvert
No. S-44
Hot Springs Boulevard,
Las Vegas
San Miguel County

This structure was constructed of a brown sandstone and was completed as a county

project in 1888. It is located near the Las Vegas Plaza Historic District and represented a major public works project upon its completion. The Hot Springs Boulevard Culvert is the oldest known bridge structure remaining in New Mexico.

North 1st Street Bridge
No. 7546
North 1st Street, Raton
Colfax County

The Raton Creek Bridge is one of only a few masonry arch bridges constructed in New Mexico. This bridge was completed in 1903 by Walter Sharp and remains an excellent example of early masonry construction and craftsmanship.

Don Gaspar Avenue Bridge
No. 3023
Don Gaspar Avenue, Santa Fe
Santa Fe County

This bridge was built across the Santa Fe River in 1934 with federal funds under the National Recovery Municipal Program. It is located within the Santa Fe Historic District and is unusual because of its arch design. It is also a good example of a number of municipal public works projects built in New Mexico during the 1930s.

Concrete Rainbow Arch

Bridge of the Hidalgos
No. 701
Grant Avenue, Santa Fe
Santa Fe County

The Bridge of the Hidalgos was constructed in 1920 by the Midland Bridge Company. The bridge's rainbow arch design is based upon a design patented by James Marsh in 1912. It is the only known bridge of this type built in New Mexico and has been listed on the State Register of Cultural Properties.

Concrete Truss

Variadero Bridge
No. 3964
NM 104 at Variadero
San Miguel County

This bridge was constructed by the Missouri Bridge and Iron Company probably between 1915 and 1920. It is the largest of four concrete truss bridges known to have been constructed in San Miguel County during the early 1900s. The Variadero Bridge is unusual because of its truss design and pre-cast construction.

El Cerrito Bridge
No. 4962
County Road 28-A at El Cerrito
San Miguel County

This bridge is also a concrete truss and has two 55-foot truss spans and four 15-foot timber approach spans. It is similar in design and construction to that of the Variadero Bridge and provides the only access across the Pecos River to the community of El Cerrito.

Concrete Beam

Delgado Street Bridge
No. 4075
Delgado Street, Santa Fe

The Delgado Street Bridge was completed across the Santa Fe River in 1928. It is a good example of the small concrete bridges which were built for municipal use prior to World War II. The site of this bridge is located within the Santa Fe Historic District.

Timber Truss

Rio Grande Bridge
No. S-19
Private Road at Embudo
Rio Arriba County

Embudo is the site of the first systematic stream gaging station in the United States and has been designated a Historic District and a Civil Engineering Landmark. The Rio Grande Bridge at Embudo is believed to have been moved to this site in 1920 from Espanola. This bridge has a Howe pony truss design with timber diagonals and iron rods for the vertical members. In recent years, steel I-beams were added over the top of the deck in an attempt to stabilize the bridge and keep it usable. The bridge at Embudo is now privately owned and it is the last remaining example of the timber truss bridges which were once common across the Rio Grande in northern New Mexico.

Pecos River Bridge
No. 239
NM 63 at Terrero
San Miguel County

The Pecos River Bridge at Terrero is a Howe through truss originally constructed in 1925 as a U.S. Forest Service project. This bridge has been by-passed and preserved in

place by the SHD and it is now used by hikers and horseback riders. It is the last timber through truss known to exist in New Mexico.

Timber Beam

Rio Grande Bridge
No. 2591
US 85 near Radium Springs
Dona Ana County

This bridge was designed by the Highway Department and was completed in 1933. It has 19 spans of 25 feet each and a total length of 475 feet. It is located near the site of Fort Selden, a military outpost established in 1865 and has been listed on the State Register of Cultural Properties as an example of the timber trestle bridges once popular in New Mexico.

Suspension

Otowi Suspension Bridge
No. 369
NM 4 at Otowi
Santa Fe County

The Otowi Suspension Bridge was designed by the SHD under the supervision of James A. French, New Mexico's first State Engineer. It was completed in 1924 and was widely recognized as a major engineering achievement for the early days of the Department. It was by-passed in 1948 and is now unsafe due to the deteriorated condition of its deck. The Otowi Suspension Bridge and adjoining area have been included on the National Register of Historic Places. It is the only remaining example of an engineered suspension bridge in New Mexico.

Railroad Underpass

San Marcial Underpass
No. 2594
NM 1 near San Marcial
Socorro County

This underpass includes a 48-foot steel girder span supported by heavy timbers at each end. The underpass was completed in 1939 by the Santa Fe Railway. The steel girder span was fabricated by the Lassig Bridge and Iron Works of Chicago in 1894, making it one of the oldest bridge structures in New Mexico.

REFERENCES

Armstrong, Ellis L.; Robinson, Michael C.; and Hoy, Suellen M.,eds. *History of Public Works in the United States, 1776-1976.* Chicago: American Public Works Association, 1976.

Beck, Warren A. *New Mexico: A History of Four Centuries.* Norman: University of Oklahoma Press, 1962.

Beck, Warren A., and Haase, Ynez D. *Historical Atlas of New Mexico.* Norman: University of Oklahoma Press, 1969.

Belasco, Warren J. *Americans on the Road.* Cambridge: MIT Press, 1979.

Bender, Averam B. "Military Transportation in the Southwest, 1848-1860." *New Mexico Historical Review* 32 (April 1957): 123-150.

Bennett, R. W. "Highway History in New Mexico." *New Mexico* 10 (June 1932): 16-18.

Bloom, Lansing B. "Early Bridges in New Mexico." *New Mexico Highway Journal* 3 (January 1925): 5-7, 18-19.

Bloom, Lansing B. "The Chihuahua Highway." *New Mexico Historical Review* 12 (July 1937): 209-217.

Burnham, John C. "The Gasoline Tax and the Automobile Revolution." *Mississippi Valley Historical Review* 48 (December 1961): 435-459.

Cheetham, F. T. "El Camino Militar." *New Mexico Historical Review* 15 (January 1940): 1-11.

Comp. T. Allen, and Jackson, Donald. *Bridge Truss Types: A Guide to Dating and Identifying.* Technical Leaflet No. 95. Nashville: American Association for State and Local History, 1977.

Condit, Carl. *American Building.* Chicago: University of Chicago Press, 1968.

Flink, James J. *The Car Culture.* Cambridge: MIT Press, 1976.

Hammond, George P., and Rey, Agipto. *Narratives of the Coronado Expedition.* Albuquerque: University of New Mexico Press, 1940.

Harper's Weekly, 14 July 1883.

Johnson, E. Dana. "New Mexico's First State Automobile." *New Mexico Historical Review* 11 (January 1936): 1-9.

Ketchum, Milo S. *The Design of Highway Bridges of Steel, Timber and Concrete.* 2nd ed. New York: McGraw-Hill, 1920.

Labutt, Jean, and Lane, Wheaton J., eds. *Highways in Our National Life.* Princeton: Princeton University Press, 1950.

MacDonald, Thomas H. "The History and Development of Road Building in the United States." Paper No. 1685. *Transactions of the American Society of Civil Engineers* 92 (1928): 1181-1206.

Moorhead, Max L. "Spanish Transportation in the Southwest, 1540-1846." *New Mexico Historical Review* 32 (April 1957): 107-122.

Myrick, David F. *New Mexico's Railroads: An Historical Survey.* Golden: Colorado Railroad Museum, 1970.

New Mexico, 1931-1960.
Between 1931-1958 each issue of this monthly magazine promoting tourism carried a brief section called "New Mexico Highway Journal."

New Mexico, State Engineer. *First Report* (July 12, 1912-December 1, 1914).

New Mexico, State Engineer. *Second Report* (December 1, 1914-November 30, 1916).

New Mexico, State Highway Engineer and State Engineer. *Annual Report* (December 1, 1916-November 30, 1918).

New Mexico, State Highway Engineer and State Engineer. *Fourth Report* (December 1, 1918-November 30, 1920).

New Mexico State Highway Engineer. *Annual Report* (December 1, 1920-November 30, 1922).

New Mexico State Highway Engineer. "Annual Report" (December 1, 1922-November 20, 1923). Typewritten report.

New Mexico State Highway Engineer. *Biennial Report* (1933-1934; 1935-1936; 1937-1938; 1939-1940; 1941-1942; 1943-1944; 1945-1946; 1947-1948; 1949-1950; 1951-1952; 1953-1954; 1955-1956; 1957-1958).

New Mexico, Territorial Engineer. *Second Biennial Report of the Territorial Engineer to the Governor of New Mexico* (1909-1910).

New Mexico Highway Journal, 1923-1931.
This monthly publication of the Highway Department replaced reports of the State Highway Engineer for 1923 to 1931. In 1931 this periodical combined with *New Mexico*, and two years later the Highway Department began issuing biennial reports.

New Mexico Press (Albuquerque), 7 February 1865.

Noble, David G., ed. *New Light on Chaco Canyon.* Santa Fe: School of American Research Press, 1984.

Plowden, David. *Bridges: The Spans of North America.* New York: Viking Press, 1974.

Rae, John B. *The Road and Car in American Life.* Cambridge: MIT Press, 1971.

Ritch, William G. *Illustrated New Mexico.* Third Edition. Published by the Bureau of Immigration, Santa Fe: New Mexico Printing & Publishing Company, 1883.

Seely, Bruce E. "Engineers and Government-Business Cooperation: Highway Standards and the Bureau of Public Roads, 1900-1940." *Business History Review* 58 (Spring 1984): 51-77.

Simmons, Marc. *New Mexico: A Bicentennial History.* New York: W. W. Norton, 1977.

Texas Tech University, Center for History of Engineering and Technology. "New Mexico Historic Engineering Site Inventory" (1979).
Inventory consists of files and research materials on historic engineering sites and structures, including roads and bridges.

Thayer, William. *Marvels of the West.* 1888.

"Timber Trusses Built With Salvage Rail in Lower Chords." *Roads and Streets* (April 1945): 76.

Tyrrell, Henry. *History of Bridge Engineering.* Chicago: Privately printed, 1911.

U.S., Department of Agriculture, Office of Public Roads. *Mileage and Cost of Public Roads in the United States,* by J. E. Pennybacker and Maurice O. Eldridge. Bulletin No. 41. Washington: Government Printing Office, 1912.

U.S., Department of Agriculture, Office of Public Works and Rural Engineering. *Public Road Mileage and Revenues in the Central, Mountain, and Pacific States, 1914.* Bulletin No. 389. Washington: Government Printing Office, 1917.

U.S., Department of the Interior, Bureau of Land Management. *Chaco Roads Project, Phase I: A Reappraisal of Prehistoric Roads in the San Juan Region,* edited by Chris Kincaid. Santa Fe: New Mexico State Office, Bureau of Land Management, 1983.

U.S., Department of Transportation, Federal Highway Administration. *American Highways, 11776-1976: A History of the Federal-Aid Program.* Washington: Government Printing Office, 1976.

Waddell, J. A. L. *Bridge Engineering.* Vol. I. New York: John Wiley, 1916.

Wallace, William S. "Stagecoaching in Territorial New Mexico." *New Mexico Historical Review* 32 (1957): 204-211.

Winther, Oscar O. *The Transportation Frontier: Trans-Mississippi West, 1865-1890.* Albuquerque: University of New Mexico Press, 1974.

APPENDIX A: RECORDED BRIDGES LISTED BY BRIDGE TYPE

Parker Pony Truss

Steel Deck Truss

Steel Arch

Steel Beam

Masonry and Concrete Arches

Concrete Rainbow Arch

Concrete Truss

Concrete Beam

Timber Truss

Timber Beam

Suspension

Railroad Underpass

**Bridges selected for their exceptional historical and engineering qualities and which are potentially eligible for the National Register of Historic Places.*

APPENDIX B: RECORDED BRIDGES LISTED BY COUNTY

Eddy County

Grant County

Guadalupe County

None

Harding County

Hidalgo County

None

Lea County

None

Lincoln County

Los Alamos County

Luna County

None

McKinley County

None

Mora County

Otero County

None

Quay County

Rio Arriba County

Roosevelt County

None

San Juan County

San Miguel County

Sandoval County

Santa Fe County

Sierra County

Socorro County

Taos County

Torrance County

Union County

None

Valencia County

None

**Bridges selected for their exceptional historical and engineering qualities and which are potentially eligible for the National Register of Historic Places.*

APPENDIX C: RECORDED BRIDGES LISTED BY BRIDGE RATING

Bridge Number	Name of Bridge	Rating
369*	Otowi Suspension Bridge - Otowi	90
357*	Rio Felix Bridge - Hagerman	84
1549*	Gallinas River Bridge - Las Vegas	84
701*	Bridge of the Hidalgos - Santa Fe	80
1382*	Gila River Bridge - Cliff	78
3964*	Variadero Bridge - Variadero	74
119*	Animas River Bridge - Aztec	70
239*	Pecos River Bridge - Terrero	70
599*	San Francisco River Bridge - Alma	70
1519*	Percha Creek Bridge - Hillsboro	70
1578*	Rio Grande Bridge - San Juan Pueblo	70
3452*	Rio Hondo Bridge - Picacho	70
6462*	Rio Grande Gorge Bridge - Taos	70
7546*	North 1st Street Bridge - Raton	70
531*	Rio Puerco Bridge - Bernardo	68
1792*	San Juan River Bridge - Shiprock	68
1894*	Cold Spring Canyon Bridge - San Lorenzo	68
5307*	Gallinas River Bridge - Montezuma	68
S-19*	Rio Grande Bridge - Embudo	68
1332*	Mimbres River Bridge - San Lorenzo	66
1520	Percha Creek Bridge - Hillsboro	66
1521	Percha Creek Bridge - Hillsboro	66
3469	Otowi Truss Bridge - Otowi	66
7622*	Los Alamos Canyon Bridge - Los Alamos	66
8118*	Largo Canyon Bridge - Blanco	66
8120*	Animas River Bridge - Cedar Hill	66
S-44*	Hot Springs Boulevard Culvert - Las Vegas	66
401	Animas River Bridge - Farmington	64
900*	Gallinas River Bridge - Montezuma	64
4962*	El Cerrito Bridge - El Cerrito	64
4984*	Mora River Bridge - Shoemaker	64
5243*	John Dunn Bridge - Arroyo Hondo	64
5507*	Kearny's Gap Bridge - Las Vegas	64
5826*	Rio Grande Bridge - Rio Grande Gorge State Park	64
2530	Rio Puerco Bridge - Albuquerque	62
5272*	Rio Hondo Bridge - Tinnie	62
8121	Animas River Bridge - Cedar Hill	62
S-13	Bolack Ranch Bridge - Farmington	62
877	Isadora Bridge - Isadora	60
1824	Railroad Overpass - Raton	60
2208*	Starkweather Canyon Bridge - Reserve	60
3023*	Don Gaspar Avenue Bridge - Santa Fe	60
6776	Nogal Canyon Bridge - Elephant Butte Reservoir	60
6777	Nogal Canyon Bridge - Elephant Butte Reservoir	60

1001*	Pecos River Bridge - San Jose	58
2594*	San Marcial Underpass - San Marcial	58
3681	Animas River Bridge - Cedar Hill	58
166*	Galisteo River Bridge - Galisteo	56
1778*	Rio San Jose Bridge - McCartys	56
2211*	San Francisco River Bridge - Luna	56
2540	Rio San Jose Bridge - Correo	56
4872	North 2nd Street Bridge - Raton	56
5285	Canadian River Bridge - Logan	56
8041	Ute Creek Bridge - Logan	56
1831	Rio Grande Bridge - Elephant Butte State Park	54
5228	Rio Pueblo Bridge - Vadito	52
7743	Chicorico Creek Bridge - Raton	52
8153	Carrizo Wash Bridge - Salt Lake	52
1782	Galisteo River Bridge - Galisteo	50
1796	Alamosa River Bridge - Truth or Consequences	50
1814	San Cristobal Creek Bridge - Galisteo	50
3806	Arroyo Aguaje Bridge - Tres Piedras	50
5445	North 1st Street Underpass - Raton	50
6089	Tijeras Avenue Underpass - Albuquerque	50
8040	Gallegos Bridge - Gallegos	50
113	Glade Arroyo Bridge - Farmington	48
1669	Rio Grande Bridge - Arrey	48
1836	Rio Grande Bridge - Española	48
2591*	Rio Grande Bridge - Radium Springs	48
5484	Rio Grande Bridge - Corrales	48
8019	Bonito Creek Bridge - Hondo	48
S-20	Glen-Woody Suspension Bridge - Pilar	48
1315	Cameron Creek Bridge - Central	46
1704	Rio Grande Bridge - Las Cruces	46
1773	Coal Avenue Viaduct - Albuquerque	46
1825	Clines Corners Overpass - Clines Corners	46
1832	Cuchillo Negro Creek Bridge - Truth or Consequences	46
1838	Bataan Memorial Bridge - Carlsbad	46
4075*	Delgado Street Bridge - Santa Fe	46
1671	Rio Grande Bridge - Hatch	44
2510	Percha Creek Bridge - Caballo	44
3248	Rio Grande Bridge - Black Mesa	44
1820	Tucumcari Overpass - Tucumcari	42
S-1	Ghost Ranch Bridge - Abiquiu	42
8	Maria Chavez Arroyo Bridge - Algodones	40
2266	Fort Sumner Underpass - Fort Sumner	40
2542	Algodones Underpass - Algodones	40
4263	Rio Grande Bridge - Shalem	40
4264	Rio Grande Bridge - Hatch	40
S-98	Seboyeta Creek Bridge - Seboyeta	40

1666	Trujillo Arroyo Bridge - Arrey	38
4283	Rio Grande Bridge - Berino	38
4551	Rio Grande Bridge - Vado	38
4552	Rio Grande Bridge - Mesquite	38
5492	South 2nd Street Underpass - Raton	38
S-110	Brushy Canyon Bridge - Alma	38
S-115	Texico Underpass - Texico	38
S-46	New Mexico Avenue Culvert - Las Vegas	36
3116	Central Avenue Underpass - Albuquerque	34
2873	Rio Grande Bridge - Anthony	32

**Bridges selected for their exceptional historical and engineering qualities and which are potentially eligible for the National Register of Historic Places.*

APPENDIX D: RECORDED BRIDGES LISTED ON THE STATE REGISTER OF CULTURAL PROPERTIES; RECORDED BRIDGES LOCATED IN OR NEAR A HISTORIC DISTRICT LISTED ON THE NATIONAL REGISTER OF HISTORIC PLACES.

Bridge Number	Bridges Listed on the State Register of Cultural Properties (SRCP)	SCRP Number
701*	Bridge of the Hidalgos - Santa Fe	545
357*	Rio Felix Bridge - Hagerman	573
2591*	Rio Grande Bridge - Radium Springs	574
1792*	San Juan River Bridge - Shiprock	575
5272*	Rio Hondo Bridge - Tinnie	744

Bridges Located In or Near a Historic District Listed on the National Register of Historic Places

	San Gabriel National Historic Landmark	5
1578*	Rio Grande Bridge - San Juan Pueblo	
	Galisteo Historic District	129
166*	Galisteo River Bridge - Galisteo	
	Montezuma Hotel Complex Historic District	227
900*	Gallinas River Bridge - Montezuma	
5307*	Gallinas River Bridge - Montezuma	
	Santa Fe Historic District	260
3023*	Don Gaspar Avenue Bridge - Santa Fe	
4075*	Delgado Street Bridge - Santa Fe	
	Las Vegas Plaza Historic District	267
S-44*	Hot Springs Boulevard Culvert - Las Vegas	
	Otowi Bridge Historic District	295
369*	Otowi Suspension Bridge - Otowi	
3469	Otowi Truss Bridge - Otowi	
	Bridge Street Historic District	339
1549*	Gallinas River Bridge - Las Vegas	
	Embudo Historic District	485
S-19*	Rio Grande Bridge - Embudo	

**Bridges selected for their exceptional historical and engineering qualities and which are potentially eligible for the National Register of Historic Places.*

APPENDIX E: FABRICATORS AND BUILDERS OF RECORDED BRIDGES

Bridge Fabrication Campanies	Bridges Completed
American Bridge Company	Galisteo River Bridge - Galisteo (No. 166)*
	Rio Grande Gorge Bridge - Taos (No. 6462)*
	Los Alamos Canyon Bridge - Los Alamos (No. 7622)*
El Paso Bridge and Iron Co. El Paso, Texas	Gila River Bridge - Cliff (No. 1382)*
	Cold Spring Canyon Bridge - San Lorenzo (No. 1894)*
	Gallegos Bridge - Gallegos (No. 8040)
	Ute Creek Bridge - Logan (No. 8041)
Kansas City Structural Steel Company	Otowi Suspension Bridge - Otowi (No. 369)*
	Rio Puerco Bridge - Albuquerque (No. 2530)
Lassig Bridge & Iron Chicago, Illinois	San Marcial Underpass - San Marcial (No. 2594)*
Midland Bridge Company	Bridge of the Hidalgos - Santa Fe (No, 701)*
	Rio Hondo Bridge - Picacho (No. 3452)*
Missouri Valley Bridge & Iron Company Leavenworth, Kansas	Isadora Bridge - Isadora (No. 877)
	Pecos River Bridge - San Jose (No. 1001)*
	Gallinas River Bridge - Las Vegas (No. 1549)*
	Variadero Bridge - Variadero (No. 3964)*
	El Cerrito Bridge - El Cerrito (No. 4962)*
	Mora River Bridge - Shoemaker (No. 4984)*
	Kearny's Gap Bridge - Las Vegas (No. 5507)*
Pueblo Bridge & Construction Company Pueblo, Colorado	Animas River Bridge - Aztec (No. 119)*
	Animas River Bridge - Farmington (No. 401)
	Largo Canyon Bridge - Blanco (No. 8118)*
Robberson Steel Company	Nogal Canyon Bridges - Elephant Butte Reservoir (Nos. 6776 & 6777)

Virginia Bridge & Iron Co. Roanoke, Virginia	Rio Puerco Bridge - Bernardo (No. 531)* Mimbres River Bridge - San Lorenzo (No. 1332)* Percha Creek Bridge - Hillsboro (No. 1520) Percha Creek Bridge - Hillsboro (No. 1521) Rio Grande Bridge - Rio Grande Gorge State Park (No. 5826)*
Virginia Bridge Company	Otowi Truss Bridge - Otowi (No. 3469)

Bridge Building Companies	**Bridges Completed**
A. O. Peabody	Galisteo River Bridge - Galisteo (No. 1782)
Armstrong & Armstrong Roswell, New Mexico	Rio Puerco Bridge - Bernardo (No. 531)*
Boardman Company Oklahoma City, Oklahoma	Rio Felix Bridge - Hagerman (No. 357)*
C. A. Switzer Basalt, Colorado	Glade Arroyo Bridge - Farmington (No. 113)
Dudley & Amesbury	Percha Creek Bridge - Hillsboro (No. 1520) Percha Creek Bridge - Hillsboro (No. 1521)
F. D. Shufflebarger Albuquerque, New Mexico	Rio Puerco Bridge - Albuquerque (No. 2530) Central Avenue Underpass - Albuquerque (No. 3116) Tijeras Avenue Underpass - Albuquerque (No. 6089)
Hayner & Burn	Alamosa River Bridge - Truth or Consequences (No. 1796)
Henry Thygesen	San Cristobal Creek Bridge - Galisteo (No. 1814)
J. H. Miller & Company	Animas River Bridge - Cedar Hill (No. 3681)
J. H. & N. M. Monaghans	Canadian River Bridge - Logan (No. 5285)
J. H. Ryan & Son	Rio Grande Gorge Bridge - Taos (No. 6462)*
James Harvey	Galisteo River Bridge - Galisteo (No. 166)*
Miller & Smith Albuquerque, New Mexico	Otowi Truss Bridge - Otowi (No. 3469)

R. E. McKee	Rio Grande Bridge - Las Cruces (No. 1704)
Salle Construction Company Pueblo, Colorado	San Francisco River Bridge - Alma (No. 599)*
Sanders Brothers Construction Company	Rio Grande Bridge - Española (No. 1836)
Schultz & Lindsay Construction Company	Nogal Canyon Bridges - Elephant Butte Reservoir (Nos. 6776 & 6777)
Sharp & Fellows	Rio Grande Bridge - Corrales (No. 5484)
Skousen Brothers	Rio San Jose Bridge - McCartys (No. 1778)* Raton Overpass - Raton (No. 1824)
Veater & Davis	Rio Grande Bridge - Rio Grande Gorge State Park (No. 5826)*
Vinson Construction Co. Phoenix, Arizona	Los Alamos Canyon Bridge - Los Alamos (No. 7622)*
W. E. Bondurant Roswell, New Mexico	Coal Avenue Viaduct - Albuquerque (No. 1773) San Juan River Bridge - Shiprock (No. 1792)* Rio Grande Bridge - Elephant Butte State Park (No. 1831) Cuchillo Negro Creek Bridge - Truth or Consequences (No. 1832) Bataan Memorial Bridge - Carlsbad (No. 1838)
Walter Sharp	North 1st Street Bridge - Raton (No. 7546)*
Ware Company El Paso, Texas	Mimbres River Bridge - San Lorenzo (No. 1332)* Percha Creek Bridge - Hillsboro (No. 1519)*

Bridge Moving Companies	**Bridges Moved**
J. H. Ryan & Son	Rio Hondo Bridge - Tinnie (No. 5272)* John Dunn Bridge - Arroyo Hondo (No. 5243)* Rio Grande Bridge - Rio Grande Gorge State Park (No. 5826)*

**Bridges selected for their exceptional historical and engineering qualities and which are potentially eligible for the National Register of Historic Places.*